SAMPLING AND ANALYSIS PLAN IN SUPPORT OF WASTEWATER TREATMENT BIOSLUDGE DELISTING

FOR

OCCIDENTAL CHEMICAL CORPORATION

INGLESIDE, TEXAS

OCTOBER 2006

Prepared by:
Elizabeth Arceneaux, P.E.
113 N. Johnson
San Marcos, Texas 78666
(512) 644-1927

TABLE OF CONTENTS

1.0 INTRODUCTION 3

1.1 OBJECTIVES 3

1.2 DESCRIPTION OF THE WASTE 3

2.0 PROCESS AND WASTE MANAGEMENT HISTORY INFORMATION 8

2.1 GENERAL OPERATIONS AT THE GENERATING FACILITY 8

2.2 CONTRIBUTING MANUFACTURING PROCESSES 12

2.3 PROCESS MATERIALS AND WASTE VOLUMES 15

2.4 INCINERATOR OPERATION AND GASEOUS EMISSION TREATMENT 16

2.5 WASTEWATER TREATMENT PROCESS DESCRIPTION AND BIOSLUDGE GENERATION 17

3.0 ANALYTICAL PLAN DEVELOPMENT 20

3.1 CONSTITUENTS FOR WHICH THE WASTES ARE LISTED 20

3.2 APPENDIX IX CONSTITUENT DETERMINATION 20

3.3 OTHER ANALYSES FOR CHARACTERIZATION 21

4.0 SAMPLING PLAN 22

4.1 SAMPLING STRATEGY 22

4.2 SAMPLING PROCEDURES 22

4.3 SAMPLE PRESERVATION AND HANDLING 25

4.4 SAMPLING DOCUMENTATION 25

4.5 SAMPLE CUSTODY 25

4.6 PACKAGING, LABELING AND SHIPPING 26

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES 29

6.0 HEALTH AND SAFETY PROCEDURES 30

APPENDICES

A Tables
B MSDS Sheets for Raw Materials used in VCM Process
C Incinerators Operating Conditions
D Backup Monthly Waste Generation Data
E DRAS Output Files for Screening May 2006
F EPA's Multiple pH Test Protocol

1.0 INTRODUCTION

The Occidental Chemical Corporation (OxyChem) plant in Ingleside, Texas produces ethylene dichloride (EDC) and vinyl chloride monomer (VCM). A site location map for the facility is shown in **Figure 1-1**. The plant utilizes two permitted onsite RCRA incinerators to burn vent gasses, intermediate wastes generated during the production of EDC and VCM (K019, K020 and F025) and occasionally waste oil and waste paint (F001, F003, F005). A third incinerator, which is not permitted under RCRA, is used solely for burning waste process vent gasses.

OxyChem has classified two waste streams that are generated from the treatment of the off-gas from the incinerators as hazardous due to the RCRA mixture and derived-from rule in 40 CFR 261.3(b)(2) and 40 CFR 261.3(c)(2). These streams are the *Limestone Clarifier Effluent* and *Wastewater Treatment Biosludge*. Both of these waste streams currently carry the listed waste codes F001, F003, F005, F025, K019, and K020. OxyChem provided a Notice of Intent letter to EPA on May 18, 2006 to delist these streams from the F and K codes as allowed by 40 CFR §260.20 and §260.22. Since that letter, OxyChem has decided to only go forward with delisting the *Wastewater Treatment Biosludge*. This sampling and analysis plan addresses the biosludge and was developed in accordance with the guidance document titled *Region 6 RCRA Delisting Petition Guidance Manual for the Petitioner*.

1.1 OBJECTIVES

The primary objective of the Sampling and Analysis Plan is to describe procedures that will be followed to collect representative samples of the *Wastewater Treatment Biosludge* that will adequately characterize it for purposes of delisting. The Sampling and Analysis plan contains justification for the analyte list for chemical characterization, sampling procedures, quality assurance/quality control procedures and health and safety considerations. OxyChem and EPA will use the chemical characterization data to determine if the biosludge is eligible for delisting.

1.2 DESCRIPTION OF THE WASTE

This plan covers the EDC/VCM *Wastewater Treatment Biosludge* since the wastewater treatment system can receive flow from the Limestone Clarifer Influent (listed waste) during maintenance or upset events.

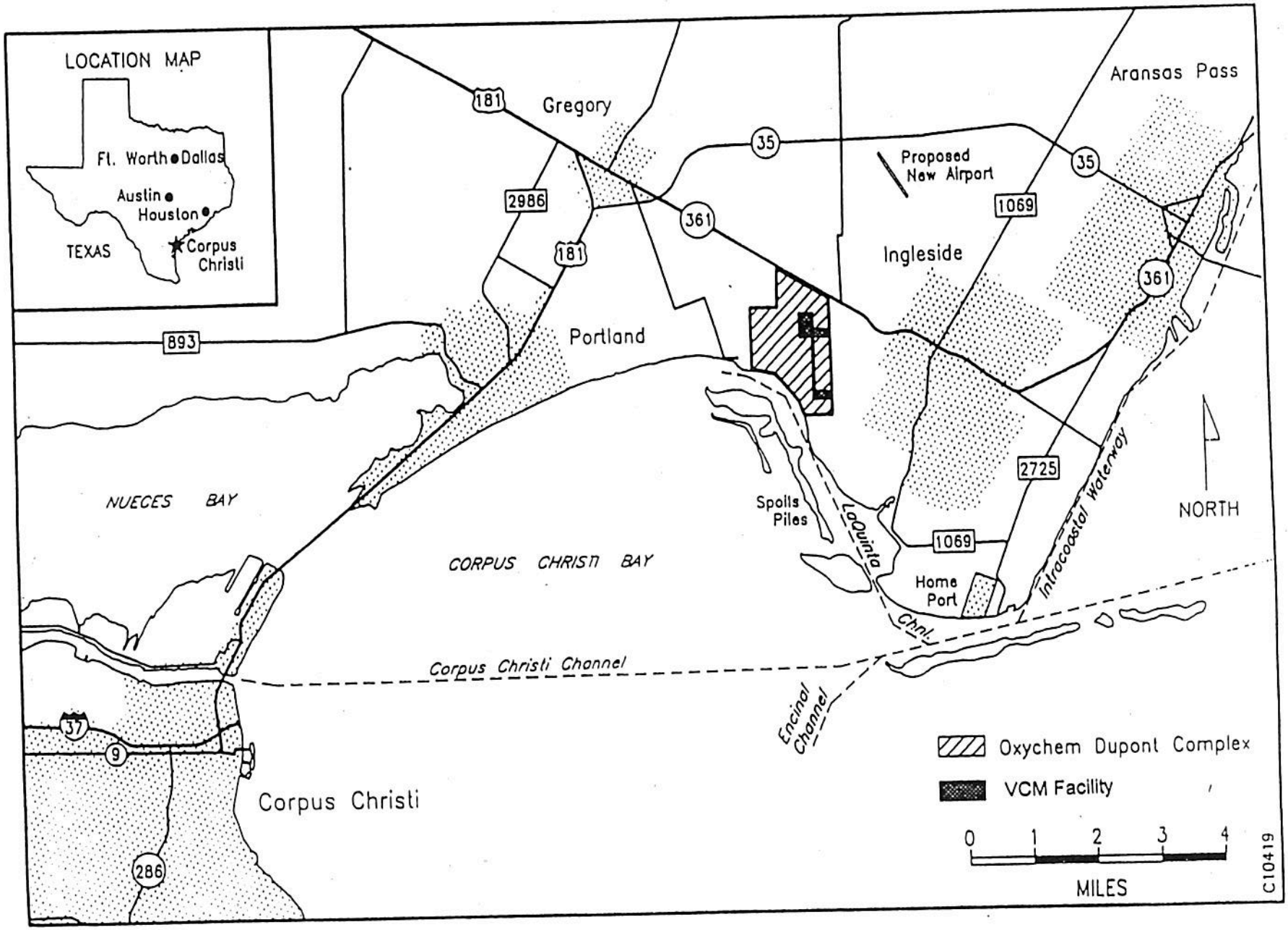
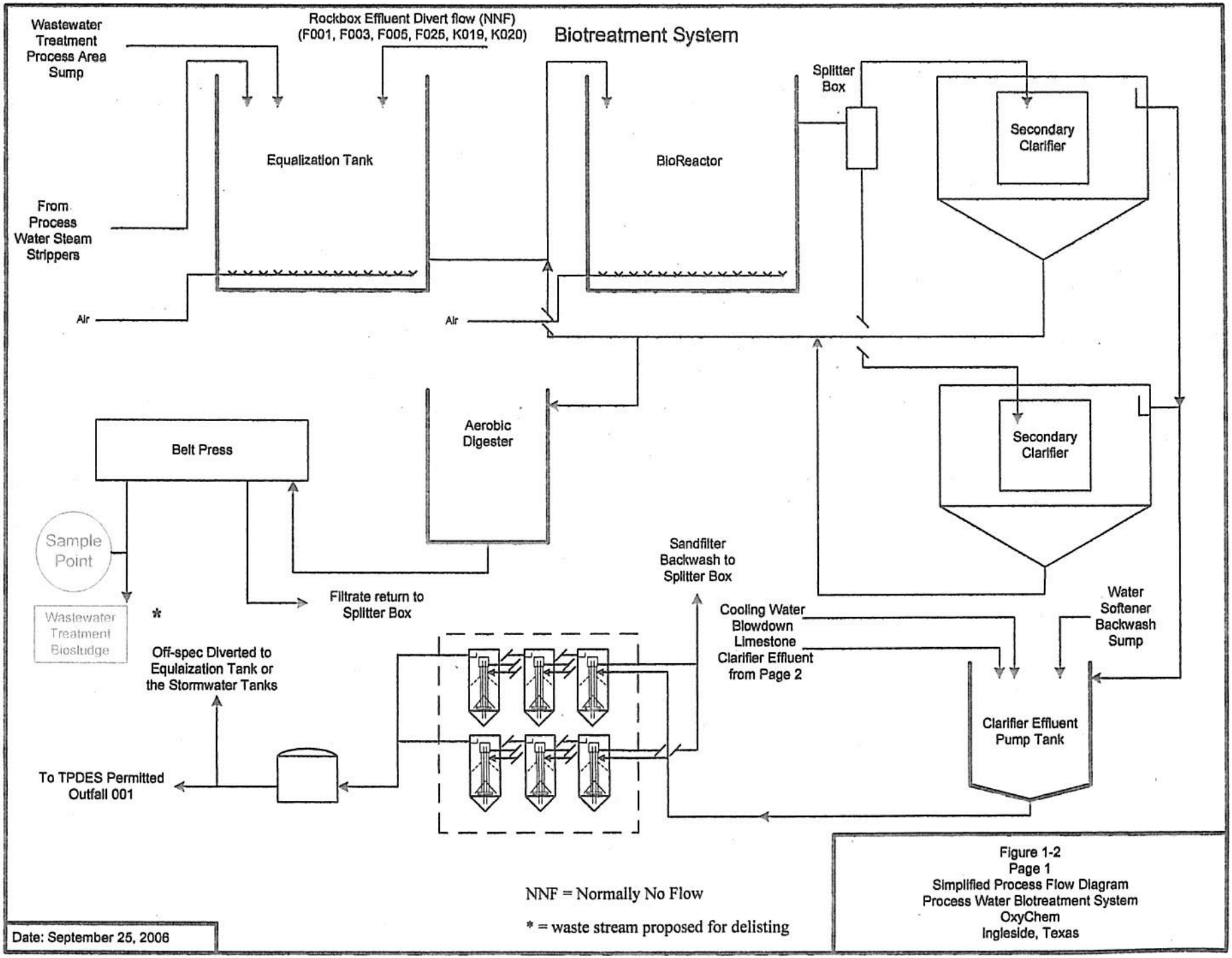
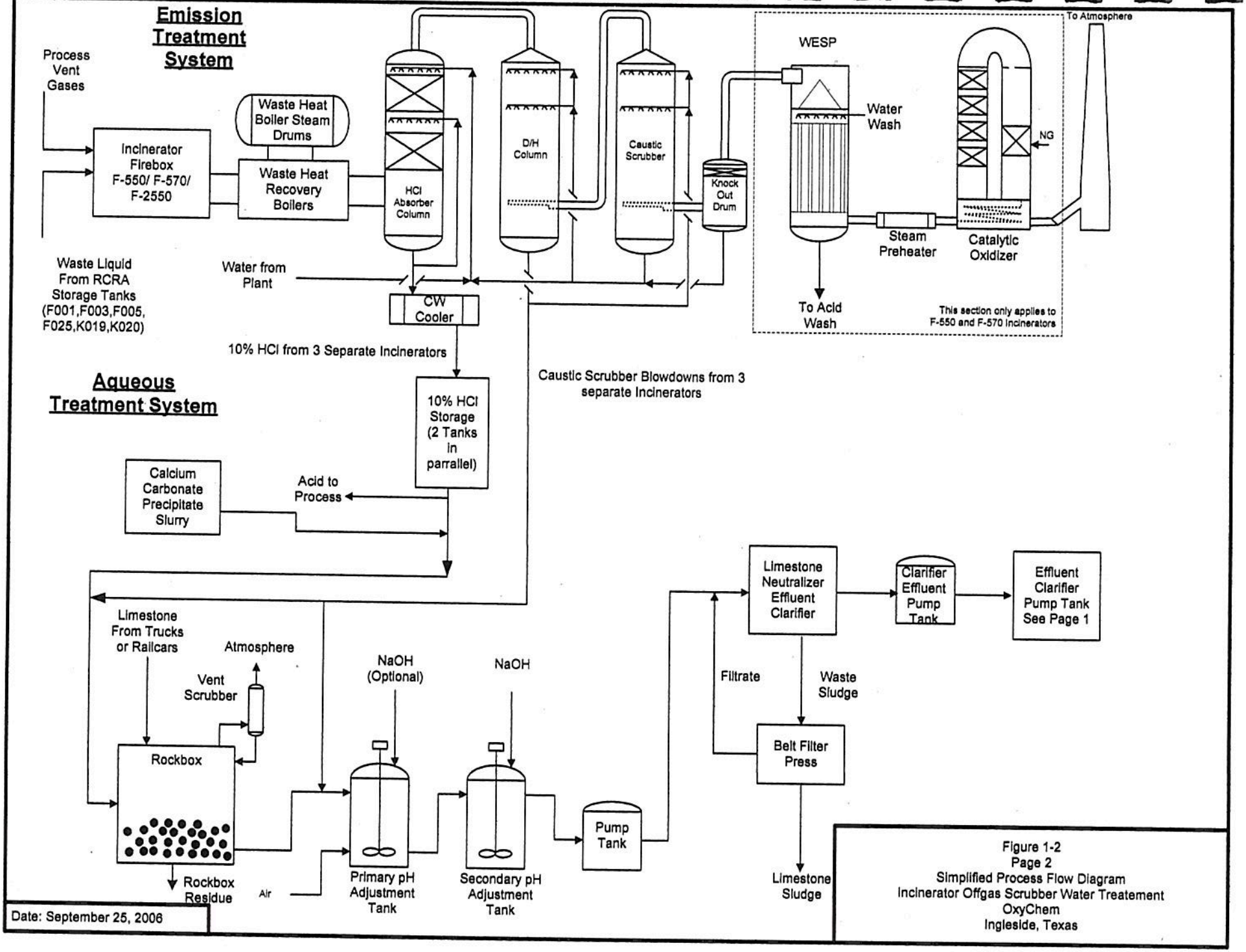


FIGURE 1-1
Area and Location Map
OxyChem
Ingleside, Texas

Figure 1-2 (page 1) shows the wastewater treatment process that generates the *Wastewater Treatment Biosludge*. As shown in page 1 of **Figure 1-2**, the Equalization Tank in the Wastewater system can receive Limestone Clarifier Influent from the Incineration Offgas Treatment System (shown in page 2 of **Figure 1-2**). This stream carries the F and K codes that cause the biosludge to be listed. As shown in **Figure 1-2**, page 2, the F and K codes are from the mixture and derived from rule of treating the offgas from the incineration of F and K listed organic wastes. The biosludge is a second or third generation waste stream from the original listed wastes and should be a good candidate for delisting.


Biotreatment System
Wastewater Treatment Process Area Sump
Rockbox Effluent Divert flow (NNF)
(F001, F003, F005, F025, K019, K020)
Equalization Tank
BioReactor
Splitter Box
Secondary Clarifier
From Process Water Steam Strippers
Air
Air
Aerobic Digester
Belt Press
Secondary Clarifier
Sample Point
Wastewater Treatment Biosludge
*
Filtrate return to Splitter Box
Sandfilter Backwash to Splitter Box
Cooling Water Blowdown Limestone Clarifier Effluent from Page 2
Water Softener Backwash Sump
Off-spec Diverted to Equlaization Tank or the Stormwater Tanks
Clarifier Effluent Pump Tank
To TPDES Permitted Outfall 001
NNF = Normally No Flow
* = waste stream proposed for delisting
Date: September 25, 2006
Figure 1-2
Page 1
Simplified Process Flow Diagram
Process Water Biotreatment System
OxyChem
Ingleside, Texas


Emission Treatment System
Process Vent Gases
Incinerator Firebox F-550/ F-570/ F-2550
Waste Heat Boiler Steam Drums
Waste Heat Recovery Boilers
HCl Absorber Column
D/H Column
Caustic Scrubber
Knock Out Drum
WESP
Water Wash
NG
Steam Preheater
Catalytic Oxidizer
To Atmosphere
To Acid Wash
This section only applies to F-550 and F-570 Incinerators
Waste Liquid From RCRA Storage Tanks (F001,F003,F005, F025,K019,K020)
Water from Plant
CW Cooler
10% HCl from 3 Separate Incinerators
Caustic Scrubber Blowdowns from 3 separate Incinerators
Aqueous Treatment System
10% HCl Storage (2 Tanks in parrallel)
Calcium Carbonate Precipitate Slurry
Acid to Process
Limestone From Trucks or Railcars
Atmosphere
Vent Scrubber
Rockbox
Rockbox Residue
Air
NaOH (Optional)
NaOH
Primary pH Adjustment Tank
Secondary pH Adjustment Tank
Pump Tank
Limestone Neutralizer Effluent Clarifier
Clarifier Effluent Pump Tank
Effluent Clarifier Pump Tank See Page 1
Filtrate
Waste Sludge
Belt Filter Press
Limestone Sludge
Date: September 25, 2006
Figure 1-2
Page 2
Simplified Process Flow Diagram
Incinerator Offgas Scrubber Water Treatement
OxyChem
Ingleside, Texas

2.0 PROCESS AND WASTE MANAGEMENT HISTORY INFORMATION

2.1 GENERAL OPERATIONS AT THE GENERATING FACILITY

The OxyChem facility produces EDC, VCM, chlorine and caustic. The primary SIC codes for the facility are 2812 and 2869. The facility is comprised of the Chlor-Alkali plant which produces EDC, chlorine and caustic, and the EDC/VCM plant. Other processes within the VCM unit include vent incineration, wastewater treatment, VCM storage and loading (railcar and ship), EDC and intermediate storage and loading, cooling towers and refrigeration and compressors.

The balanced process for the production of VCM utilizes chlorine, ethylene, and oxygen as feedstock. The process is shown schematically in the block flow diagram in **Figure 2-1**. There are five principal steps in the VCM production process:

1. Direct chlorination of ethylene to EDC;

2. Purification of EDC which is newly produced as well as that recycled from VCM product purification;

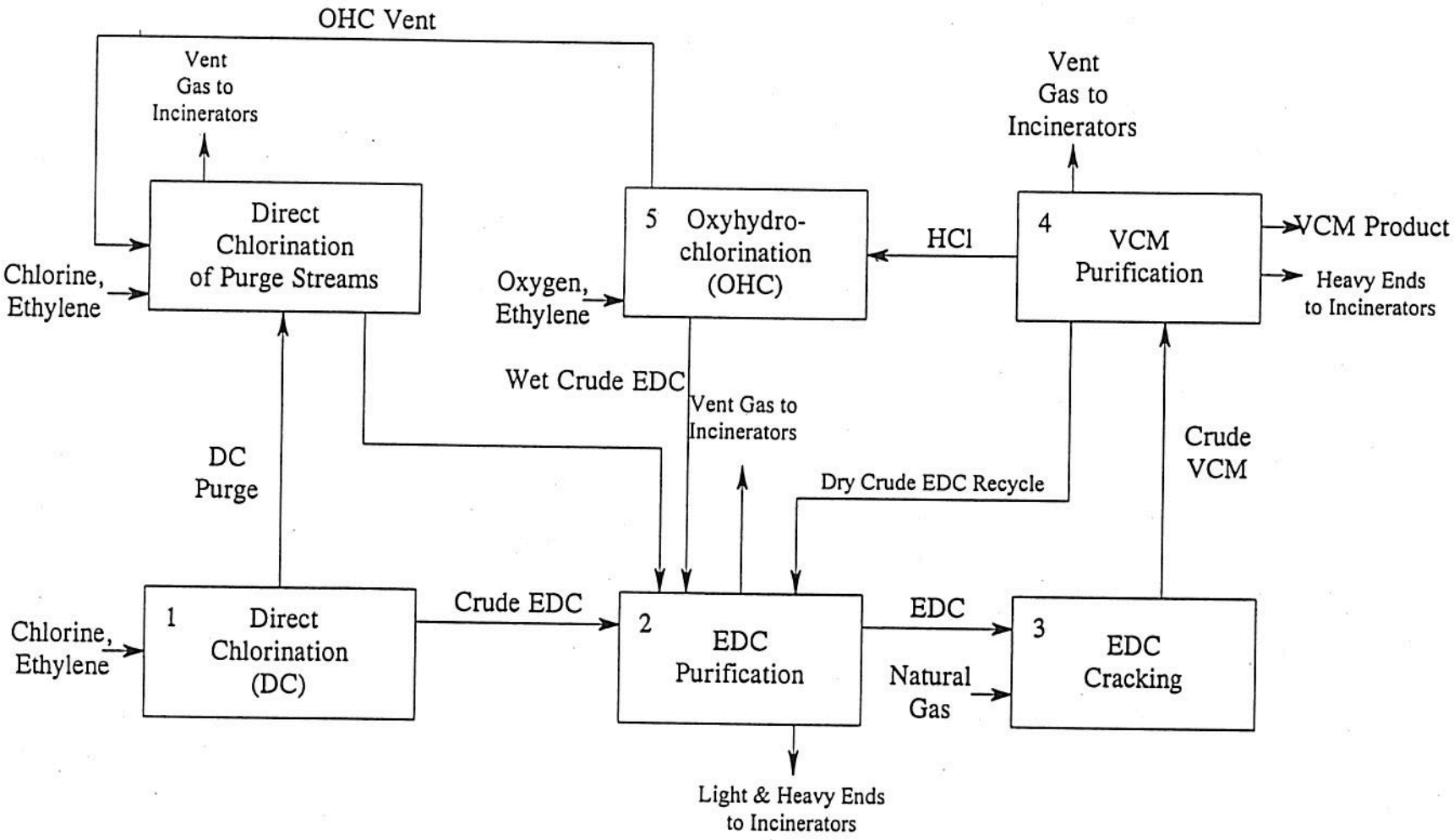
3. EDC cracking to VCM and HCl;

4. Final VCM product purification; and

5. Oxyhydrochlorination (OHC) of ethylene with HCl from cracking and oxygen to produce EDC.

Some of the wastes generated at the OxyChem facility include EDC heavy ends, VCM light ends and heavy ends, spent catalyst and filters, Mother Liquor, furnace coke, incinerator ash, waste oil, waste paint thinner, and miscellaneous solids such as sludge, scale, tank residue and spent activated carbon. A list of the hazardous wastes generated at the facility is shown in **Table 1 (Appendix A)** along with the TCEQ and EPA waste codes for each.

There are eight hazardous waste treatment and storage units at the facility. These units are authorized under the RCRA Permit No. HW-50322 (expires June 16, 2015). The hazardous waste management units include two incinerators



Note: Numbers correspond to Process Steps in Section 2.1.

DATE **October 2006** | W. O. NO. **007-01**

FIGURE 2-1
Process Flow Diagram - VCM Production
Oxy Chem - Ingleside, Texas

(Unit Numbers 550 and 570), two spherical storage tanks (C-720A and C-720B), and three container storage areas. A third interim status tank (6D-02) can also be used to store EDC heavy ends (or by-product). The locations of these units are shown in **Figure 2-2. Table 2** shows the waste streams managed in each permitted unit.

The two incinerator units are used to incinerate vent gases from the process area in addition to the following five liquid hazardous waste streams:

- VCM light ends,
- VCM heavy ends,
- EDC heavy ends (or byproduct)
- Mother Liquor
- Waste oil
- Waste paint

The incinerators are identical in design and are operated in parallel. No incompatible materials or waste are incinerated at the OxyChem facility. Each incinerator has a rated capacity of 34×10^6 BTU/hour. A third incinerator is used to burn vent gases from the process areas. It is not a RCRA-permitted incinerator; however, the off-gas treatment system generates water that combines with the two RCRA permitted incinerator scrubber waters, making the combined scrubber streams RCRA hazardous by the mixture rule.

Two identical spherical storage tanks serve as hazardous waste feed tanks for the two incinerator units. Each tank has a maximum capacity of 65,000 gallons. Tanks C-720A and C-720B are used to store VCM light ends, VCM heavy ends, and/or EDC heavy ends. Due to a lower water content requirement imposed on waste oil by OxyChem process engineers, no waste oil has been stored in Tank C-720A or incinerated since early 1994. Interim status tank 6D-02 has a capacity of 35,000-gallon and it can store EDC heavy ends (or by-product).

Hazardous wastes that cannot be incinerated are containerized for off-site disposal and may be stored on-site at either the Chlor-Alkali or VCM container storage areas. Although the container storage areas are permitted as greater than 90-day storage, wastes are usually shipped off site in less than 90 days.

Dewatered sludge formed from the neutralization of the aqueous stream from the incinerators is collected at the Limestone Sludge container storage area. The sludge is collected in a rolloff box after it passes through a belt filter press. The limestone sludge storage area is used to store incinerator limestone sludge and the *Wastewater Treatment Biosludge*.

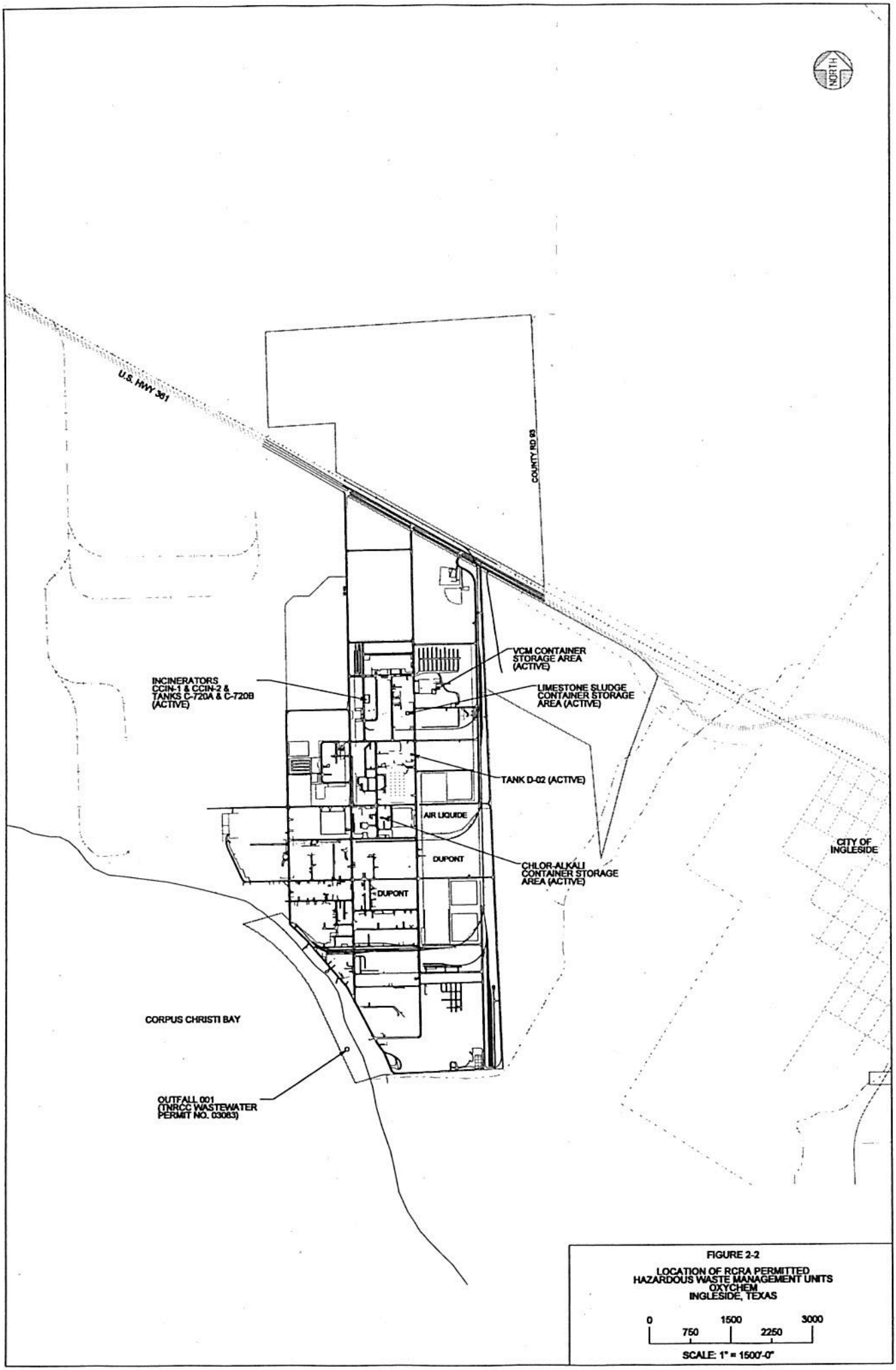


FIGURE 2-2

LOCATION OF RCRA PERMITTED HAZARDOUS WASTE MANAGEMENT UNITS
OXYCHEM
INGLESIDE, TEXAS

0 750 1500 2250 3000

SCALE: 1" = 1500'-0"

A list of permits held by the OxyChem VCM Ingleside Plant is as follows:

Hazardous Waste:	RCRA permit number HW-50322-000 Initial Issue Date September 23, 1991 Permit Renewal Date May 16, 2001 Renewed Permit Date June 16, 2005
TPDES Permit:	TCEQ Permit No. WQ-03083
TCEQ Air Account No.:	SD-0092-F
Air Permits:	Federal Operating Permit No. O1240 Cogeneration Project Permit Nos. 35335 and PSD-TX-880 LNG Terminal Permit No. 74185 Chlor-Alkali Facility Permit No. 2339A Former Chlor-Alkali EDC Plant Permit No. 18432 VCM Plant Permit No. 19169

2.2 CONTRIBUTING MANUFACTURING PROCESSES

The manufacturing processes that contribute waste and vent gases to the incinerators are the VCM plant and the support plants (ship and rail loading, product storage tanks, RCRA tanks and wastewater storage tanks). The former EDC unit in the Chlor-Alkali Plant once contributed waste streams, but was idled in 2002. A description of each contributing process (including the former EDC unit) is presented along with a discussion of the waste streams that are sent to the incinerators.

2.2.1 Former EDC Unit in Chlor-Alkali Plant

The Chlor-Alkali ethylene dichloride unit utilizes chlorine and ethylene as feedstock to produce sales grade ethylene dichloride. This process has been idled since 2002 and no wastes have been generated or burned in the onsite incinerators since 2002. OxyChem will keep this unit in the delisting petition. Also similar EDC waste streams from sister plants may be burned in the incinerators. The sister plant in Convent, Louisiana is identical in process design as the former EDC unit in the Chlor-Alkali Plant.

EDC is formed by the direct chlorination of ethylene in the presence of a ferric chloride catalyst. The EDC product is boiled off by the heat of the reaction and condensed. Crude EDC is washed with dilute acid solution followed by water and dilute caustic soda to remove the ferric chloride catalyst and any dissolved chlorine. Wastewater from this process is treated in its own wastewater treatment plant.

The wet EDC is purified by routing the product through fractionating columns that separate EDC from low boiling impurities (light ends) and high boiling impurities (heavy ends). The heavy ends are either sent offsite to another plant for use as a feedstock or burned in the RCRA incinerators in the VCM plant. From 1991 through 1993, the heavy ends were used as feedstock. During the last quarter of 1994, they were burned in the onsite incinerators.

Production of EDC is a continuous process and the wastes are consistent during operation. **Table 3** shows the range of constituents detected in the EDC Heavy Ends from 1998 to 2002 during annual waste analysis and the most recent Trial Burn (June 7, 2002). The laboratory reports for these samples are available for review upon request.

2.2.2 VCM Plant

The production of VCM is accomplished by the thermal cracking of purified EDC. The EDC feedstock is vaporized and then enters a cracking furnace. The cracking reaction takes place in a pyrolysis furnace at temperatures of about 900°F. HCl formed in the pyrolysis reaction is used in the oxychlorination process.

The product gas stream is quenched as it leaves the cracking furnace. The quenched stream enters a column which removes carbon and VCM heavy ends. The VCM heavy ends are processed to recover VCM and EDC and then are routed to RCRA tank C-720B for use as liquid feed to the two RCRA incinerators.

The crude VCM leaving the quench column is further purified to remove HCl and uncracked EDC. The HCl is fed as a gas to the oxyhydrochlorination section, and the EDC is pumped to intermediate storage prior to being recycled to the EDC purification section. VCM product is routed to VCM storage spheres for loading.

EDC is also produced in the VCM plant as a product feed for VCM production. EDC is produced by the vapor phase reaction of ethylene with hydrogen chloride in the presence of an activated alumina/copper chloride catalyst. This process, called oxyhydrochlorination, is highly exothermic and the heat of the reaction is used to generate steam for the process. The gases leaving the oxyhydrochlorination reactors are cooled to condense EDC and water. The wet crude EDC is dried using azeotropic distillation in the EDC purification unit and separated from the light ends and heavy ends through a distillation column.

Continuous vent gases from the VCM Plant primarily contain EDC, ethyl chloride, carbon dioxide, nitrogen, and ethylene, and are routed to the incinerators for destruction. The light ends and heavy ends from the VCM Plant are routed to RCRA storage tanks for use as liquid feed to the two RCRA incinerators. These waste streams are analyzed once a year for organic and inorganic constituents. The most recent analysis included the volatile and semivolatile organics and RCRA metals.

Table 3 shows the range of constituent concentrations found in the VCM Plant heavy ends and light ends from 1998-2005.

As shown, the VCM Plant light ends consist primarily of carbon tetrachloride, chloroform, 1,1-dichloroethane, 1,2-dichloroethylene, 1,2-dichloroethane and chloroprene. The VCM Plant and former EDC unit heavy ends are over chlorinated byproducts from the production of EDC and VCM and include chloroform, carbon tetrachloride, 1,2-dichloroethane, 1,1,2-trichloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene and bis (2-chloroethyl) ether.

2.2.3 Support Plants

Support plants for the VCM unit include railcar and ship loading, two RCRA tanks for heavy ends and light ends storage, intermediate and final EDC product storage tanks, storm water tanks and the CoGen process unit. The ships and railcars are dedicated for VCM service and are purged with nitrogen to remove air prior to loading. All of the tanks have nitrogen pads and vent nitrogen to the incinerators during loading and thermal expansion. There are no analytical data for the vent gases; however, composition is based on knowledge of the process.

2.2.4 Mother Liquor Waste

In the direct chlorination system of the EDC processes, chlorine and ethylene are sparged into the reactor line of the Direct Chlorination Reactor where they react to form EDC. The reaction requires a ferric chloride catalyst, which is introduced into the reactors before initial startup. The vapor EDC is condensed and sent to the light ends column. The heavier ends and the ferric chloride catalyst remain in the reactor. If this mixture gets wet, or the concentration of iron exceeds a threshold limit, the reactor is cleaned. The iron-rich organic liquid is referred to as Mother Liquor and is generated on a batch basis. It can be burned in the incinerators onsite; however fouling from the high iron concentration has lead to offsite management. **Table 4** shows the typical constituents detected in the Mother Liquor waste when it was generated in the past. Since the EDC unit has been idled (2002), this waste stream has not been generated.

2.2.5 Maintenance Activities

Waste oil is generated during maintenance of pumps or other oil containing equipment. Oil in transformers, compressors or other electrical equipment does not contain PCBs. This equipment was installed in the early 1990s after the use of PCBs as a dielectric was discontinued. The oil is collected in drums in satellite areas until each drum is full. The oil is stored in one of the container storage areas and tested for water content. If the water content

passes internal process criteria, the oil is pumped into the heavy ends RCRA storage tank for use as feed to the incinerators.

Most of the oil contains water in excess of the plant-imposed moisture limit, so it is transported to an offsite hazardous waste management facility rather than incinerated onsite. Waste oil has not been incinerated onsite since early 1994 but may be incinerated in the future. Typical constituent concentrations in the waste oil are shown in **Table 5**.

2.2.6 Sister EDC/VCM Waste Streams

OxyChem needs flexibility to burn similar EDC/VCM waste streams from its other sister plants in LaPorte Texas, Convent Louisiana, and Deer Park Texas. These plants have very similar processes and generate similar VCM and EDC waste streams (carrying the same K and F waste codes). The former EDC unit at Ingleside is identical to the Convent, Louisiana plant. OxyChem obtained a permit amendment from the Texas Commission on Environmental Quality (TCEQ) on September 11, 2006, which authorizes these off-site waste streams to be processed in the RCRA-permitted incinerators.

Table 6 shows the typical organic and inorganic constituents detected in the La Porte, Deer Park and Convent plants. These are shown in comparison to those detected in the waste streams at Ingleside. This table shows that the VCM heavy ends at all of the plants have low concentrations of metals (in the low ppm) and higher concentrations (in weight percent) of volatile organics. The predominant volatile organics in all the heavy ends are 1,2-dichloroethane, hexachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene and 1,1,2-thrichloroethane. The EDC heavy ends contain primarily bis (2-chloroethyl) ether, 1,2-dichloroethane, hexachlorobenzene and 1,1,2-trichloroethane.

2.3 PROCESS MATERIALS AND WASTE VOLUMES

The primary raw products used in the EDC and VCM process are ethylene, chlorine, and oxygen. Ferric chloride catalyst, activated alumina/copper chloride catalyst and HCl are also used to a lesser extent. Material Safety Data Sheets for the primary raw materials are in **Appendix B**. From 2002 through 2005 OxyChem utilized between 864,012 to 1,096,127 Mlbs of ethylene, 1,303,852 to 1,411,651 Mlbs of chlorine and 302,023 to 324,564 Mlbs of oxygen.

The volume of the liquid waste streams and process vent gases incinerated from 2002 through 2005 is shown in **Table 7**. As shown, the VCM Plant heavy ends make up the majority of the materials incinerated, followed by the VCM Plant light ends. There was no Mother Liquor or waste oil incinerated during this time. The volume of EDC heavy ends incinerated declined to zero in 2002 due to OxyChem idling the EDC process unit.

2.4 INCINERATOR OPERATION AND GASEOUS EMISSION TREATMENT

Incineration of process vent gases, VCM Plant heavy ends and VCM Plant light ends is a continuous process that does not change seasonally. The influent constituents to the incinerators may change in concentration during plant upsets or planned VCM Plant shutdowns and startups, however, the components remain the same. Natural gas is used as an auxiliary fuel source and is metered at 0 to 300 scfm to control the firebox temperatures specified in the permit.

The permitted operating conditions for the incinerators are in the facility's current Notification of Compliance (NoC) pursuant to the applicable requirements of 40CFR 63 Subpart EEE [40 CFR 264,340(b)(1)]. The NoC is in **Appendix C**.

Incinerator Offgas Treatment System

As shown in **Figure 1-2** (page 2), the combustion products from the incinerators contain hydrochloric acid (HCl). The emissions are passed through the HCl absorption columns, dehumidifier columns and caustic scrubbers to remove the HCl and chlorine. Blowdown water from the dehumidifier columns and caustic scrubber columns are routed to the Rockbox as the first step in neutralizing the HCl or to the bioplant for pH adjustment. Blowdown from the absorption columns are routed to two 10% HCl storage tanks. Excess HCl from the 10% HCl storage tanks is routed to the Rockbox. The influent to the Rockbox normally contains 3 to 15 percent hydrochloric acid depending on the operating conditions of the incinerators.

Blowdown from two Wet Electrostatic Precipitators (WESP) is routed back to the process and used as makeup water to the EDC acid wash system. The WESPs are designed to remove particulate matter, semi-volatile metals (SVM) and low volatile metals (LVM) from the effluent gas. The WESP is a cylindrical vessel packed with 10-inch diameter tubes that extend the length of the vessel. The incoming air passes through the tubes where electrodes charge the particles and water droplets present in the feed stream. The electrically charged particles and droplets migrate to the tube walls and gravity flow out the bottom of the column. The tubes are periodically cleaned (washed) on-line by feeding water directly into the vessel.

The final emissions control device is the catalytic oxidizer, which further removes traces of PCDD and PCDFs from the gaseous emissions. The reaction takes place at 450°F over a series of catalyst beds. The effluent gas is cooled after the reactor by interchanging with the feed gas, and the resulting gaseous stream is forwarded to the stack. No wastewater stream is produced from the catalytic oxidizers.

The Rockbox contains crushed limestone (calcium carbonate) to neutralize the excess HCl acid. Calcium carbonate precipitate slurry is also injected into the acid waste stream prior to the Rockbox to help neutralize the acid. The crushed limestone, also called the Rockbox Residue, was delisted on January 29, 1999.

The pH of the effluent leaving the Rockbox is typically between 0 and 4. The effluent flows through a primary pH adjustment tank where air is purged into the water to remove carbon dioxide. Additionally, sodium hydroxide can be added to this tank. Purging with air minimizes the formation of calcium carbonate precipitate upon introduction of caustic. The effluent is then passed through the secondary pH adjustment tank where caustic (sodium hydroxide) is added to raise the pH of the water to between 7 and 9. This waste stream consists of an aqueous phase (no longer exhibiting the corrosive hazardous characteristic) and a solid phase of calcium carbonate precipitant in suspension. The calcium carbonate is settled in a clarifier and pressed to become Limestone Sludge (delisted on January 29, 1999). The effluent from the clarifier is commingled with other wastewater streams (including the Bioplant discharge described below) prior to filtration.

2.5 WASTEWATER TREATMENT PROCESS DESCRIPTION AND BIOSLUDGE GENERATION

2.5.1 Process Description

The EDC/VCM Wastewater Treatment System receives process wastewaters from the EDC/VCM process area sumps and the process water steam strippers. During upset conditions, the Equalization Tank can receive diverted flow from the Limestone Clarifier Influent
(see **Figure 1-2**, page 1). The Equalization Tank provides surge volume for the treatment system. From the Equalization Tank, the wastewater is treated through the Bioreactor that breaks down dissolved organic constituents through aerobic biological treatment. The hydraulic retention time of the bioreactor is designed for 21 to 29 hours.

Biomass is generated in the treatment process and the effluent containing these biosolids flows by gravity through a splitter where flow distribution is controlled to two Effluent Clarifiers. A polymer is added to improve solids settling. The biosolids settle to the bottom of the clarifiers and are moved to the center by rotating sludge rakes. The biosolids are withdrawn by pumps and returned to the biotreater. Some of the recycled biosolids are wasted to the Aerobic Digester to keep the correct balance of biomass in the biotreaters.

The primary function of the digester is to reduce the amount of biological material that must be processed and disposed. This is accomplished through further reduction of mass by

aerobic processing. The digester is designed to hold three days production of biosolids from the clarifiers. When the digestion has taken place, the Belt Press is activated and the contents are processed through the belt press system.

The biosolids are processed to the Belt Press on a batch basis for 2 to 4 days. Polymers are added to enhance dewatering. The water from the biosolids drains through the porous belt as the sludge is fed through the belt system and the filtrate is recycled to the splitter box. The sludge is then carried through two moving belts that apply pressure and finally through rollers where additional pressure removes more water. The presses concentrate the sludge to about 18% solids.

The dewatered sludge is deposited into rolloff boxes for collection and offsite disposal. This sludge is the *Wastewater Treatment Biosludge* designated for delisting.

As described above, biosolids generated in the aerobic process can be recycled back into the bioreactor or wasted to the aerobic digester. The solids residence time is the time it takes for the entire sludge volume to be removed from the bioreactor (complete turnover). For this system, the solids residence time is approximately 45 days.

2.5.2 Wastewater Treatment Biosludge Generation and Volume

The *Wastewater Treatment Biosludge* has been generated continuously since 1990. **Table D-1** in **Appendix D** shows the annual volume generated for the past five years (2001-2005). Both the monthly and annual volumes are shown per EPA guidance. As shown, the annual volume varied slightly during this time from 1,900 cy/year to 2,838 cy/year. The maximum annual volume was generated in 2002 and was 2,838 cubic yards. This volume was increased by 30% to allow for possible future expansion to a maximum volume of 3,689 cy/year. This is the volume of sludge that will be used for the DRAS modeling runs.

OxyChem collected two sludge samples for total analysis (Appendix IX) on January 26, 2006 and February 1, 2006. Then OxyChem collected two more samples on March 22, 2006 and March 28, 2006 and analyzed the sludge for dioxins/furans and metals on the TCLP extract. **Table 8** shows the maximum concentration of the constituents detected in the *Wastewater Treatment Biosludge* during these sampling events. The sludge is not a characteristic waste but does contain volatiles organic constituents, metals and dioxins/furans. The laboratory reports for these samples are available for review upon request.

The concentrations were entered into the EPA's DRAS Version 2.0 program for screening the data for delisting levels. The program was run using the maximum annual sludge volume of 3,689 (DRAS output files in **Appendix E**). As shown in, **Table 8** the data passed the delisting levels with the exception of TCLP thallium. Thallium was not detected in any other

sludge sample leachate at this level and it was not detected on a total basis in any sample. The data is thought to be an outlier due possibly to laboratory error.

3.0 ANALYTICAL PLAN DEVELOPMENT

3.1 CONSTITUENTS FOR WHICH THE WASTES ARE LISTED

The *Wastewater Treatment Biosludge* carries the following listed hazardous waste codes: F001, F003, F005, F025, K019 and K020. **Table 9** shows the list of constituents that form the basis-of-listing (40 CFR 261, Appendix VII) for these codes. The constituents are volatile organics and semivolatile organics.

3.2 APPENDIX IX CONSTITUENT DETERMINATION

The waste streams incinerated are consistent and well characterized through annual waste analysis. A summary of the constituents detected in the waste streams that are burned (or may be burned) in the incinerators was presented in **Tables 3** through **6**. The components include volatile organics, semivolatile organics and several metals (arsenic, barium, cadmium, chromium, iron, lead, selenium).

Dioxins and furans may form as a byproduct from the incineration of chlorinated compounds. As shown in **Tables 3** through **6**, most of the constituents in the waste streams incinerated are chlorinated alkanes and alkenes measured in the percentile range. Analysis of dioxins and furans is therefore appropriate. It is unlikely that the Appendix IX pesticides, herbicides and PCBs will be present in the waste streams since these compounds are not used as raw products or generated in the waste streams. However, at least one sample of the *Wastewater Treatment Biosludge* will include these analyses.

In accordance with Exhibit 2 of Section 6 of the "*EPA RCRA Delisting Program Guidance Manual for the Petitioner*," the proposed analytical program for the Wastewater Treatment Biosludge will include:

- One sample with constituent analyses for the entire Appendix IX constituent list (including PCBs, pesticides and herbicides and dioxins/furans) on a Total Basis and on the TCLP extract;
- Multiple TCLP pH testing for Appendix IX metals using pHs of 3, 5 and 10;
- Appendix IX volatile, semivolatile and metal analyses for the remaining three samples on a Total Basis and on the TCLP extract;
- Dioxin/furan analyses for the remaining three samples on a Total Basis and on the TCLP extract

- Characteristic analyses including Toxicity Characteristic, pH, ignitability, total sulfide, total cyanide;
- Total oil and grease and Percent Moisture.

These analyses include the constituents that form the basis-of-listing as well as the analyses to determine hazardous waste characteristics. The analyses on the sludge samples will be reported on a wet weight basis since the sludge is not dried prior to disposal.

3.3 OTHER ANALYSES FOR CHARACTERIZATION

In accordance with Section 6.6.2 of the *EPA RCRA Delisting Program Guidance Manual for the Petitioner*, the samples will be analyzed for total oil and grease, total cyanide and total sulfide. If the concentration of total cyanide and total sulfide exceed 250 mg/Kg and 500 mg/Kg respectively, reactive cyanide and reactive sulfide will be run.

Table 10 shows the analytical slate and EPA methods for characterizing the *Wastewater Treatment Biosludge*. All analytical methods will be conducted in accordance with EPA SW-846 Test Methods for Evaluating Solid Waste-Physical and Chemical Methods or similar equivalent methods.

4.0 SAMPLING PLAN

4.1 SAMPLING STRATEGY

In a delisting petition, the generator must demonstrate to the EPA that the waste in question does not meet any of the initial listing criteria, does not exhibit any hazardous waste characteristics and does not contain any other toxic constituents at hazardous levels. This demonstration must be supported by analytical data generated from sampling of the waste. Since the analytical data is critical to the petition, the waste samples must be representative of the waste, and the integrity of the samples must be maintained until the required analyses are performed. The sample strategy is therefore developed to meet these requirements.

A sampling strategy is generally based on either temporal variability or spatial variability. Temporal variability is most often used when point source discharges are sampled. Spatial variability is most often used when a container, pile, landfill, or lagoon is to be sampled. The processes generating the waste streams that are incinerated at OxyChem are continuous and the character of the waste streams incinerated does not change significantly over time. Likewise, the characteristics of the influent stream to the offgas neutralization system are consistent over time. It is therefore reasonable to assume that the characteristics of the *Wastewater Treatment Biosludge* will be relatively consistent over time. Both temporal and spatial variability will be addressed with the procedures to sample the biosludge.

4.2 SAMPLING PROCEDURES

In accordance with the *Region 6 RCRA Delisting Petition Guidance Manual for the Petitioner*, four samples and one duplicate of the biosludge will be collected for the delisting characterization. Temporal variability will be assessed by collecting four samples over a minimum 4 week period of time. The sludge is collected into bins or rolloff boxes for disposal. Spatial variability will be addressed by sampling the sludge off the belt press every two hours until the bin is filled:

Wastewater Treatment Biosludge

The OxyChem wastewater treatment system operates under various conditions depending on operational and maintenance needs. *Biosludge* sampling will occur during worse-case conditions determined by process knowledge. The worst-case condition will include diverting the *Limestone Clarifier Influent* to the biological treatment system for a period of time that OxyChem could be expected to operate without adversely affecting the biological treatment system. The sampling may or may not occur over a consecutive four week period.

The sampling procedures are as follows:

1. Two hours after starting to fill a new bin and every two hours there after, until the bin is full, catch a belt press sample in a scoop as it falls into the bin and then transfer it into a sample container. During the first grab sample (only) fill a sample container and a small (4- to 8- ounce wide mouth jar) completely to the top for the Volatile Organic Analyses (VOA) sample. Dispose of the unused belt press cake sample back into the roll off bin.
2. Record on the log sheet (**Figure 4-1**) the time that the belt cake was collected.
3. Label the top of the sample container as follows:
    a. Bin Number
    b. Grab Sample Time
    c. Grab Sample Date
    d. "Wastewater Treatment Biosludge Grab 1, Grab 2, etc."
4. Store the grab sample container in a cooler filled with ice
5. When the bin is filled, stop sampling and send the samples to the lab to form a composite sample.
6. Alternately, composite the sample with the following method:
    - Composite in a stainless steel bowl using a stainless steel spoon.
    - Fill all sample bottles provided by the lab for WEEK 1 (WEEK 2, etc.) with the composite sample and complete the sample label on each containers (include date/time of compositing and sampler initials). Add the sample I.D. *Wastewater Treatment Biosludge – WEEK 1, WEEK 2, etc.*
7. Pack the samples into a cooler with ice and prepare the samples for overnight shipment to the laboratory.
8. Decontaminate the stainless steel bowl and spoon using phosphate free laboratory-grade detergent and deionized water.
9. Repeat Steps 1-8 for Weeks 2,3, and 4 (not necessarily consecutive weeks).

QA/QC Samples

- On Week 1 samples only, collect one field blank at the filter press for the biosludge sample location. Collect the field blank by filling a clean VOA vial with deionized water near the sample port. Request only Appendix IX volatile analyses for the field blank.

- On the Week 1 sample only, for the *Wastewater Treatment Biosludge* request that the TCLP leachate used to extract the sludge for metals be adjusted in the lab to pH 3, pH 5 and pH 10. This will be requested on the chain-of-custody form.

- On Weeks 2 and 4 only, carry trip blanks for analysis of Appendix IX Volatile organics.

FIGURE 4-1

Wastewater Treatment Biosludge
Grab Sampling Record

Record data as each grab sample is collected

GRAB #	DATE/TIME	INITIALS	

- On the Week 3 samples only, collect a duplicate composite sample of the *Wastewater Treatment Biosludge* by collecting twice the volume from the belt press every two hours (i.e. fill two containers). Duplicate analyses will be run on volatiles, semivolatiles, dioxin/furans and oil and grease and characteristic analyses (sulfide, cyanide).

On the label and chain-of-custody, the sample date and sample time will be the date and time the sample is composited. The sampler must be sure to sign (as the sampler) and also as the first person to relinquish custody to the courier or lab. The method of preservation must be included on the chain-of-custody form for each sample.

4.3 SAMPLE PRESERVATION AND HANDLING

All samples will be placed in clean containers provided by the laboratory. The preservation method for solid samples is to chill to less than 4°C. The sample container, preservatives and recommended holding times for the Wastewater Treatment Biosludge are shown in **Table 11.**

4.4 SAMPLING DOCUMENTATION

To prevent misidentification of samples, labels will be attached to each sample container. The labels will be water proof and legible and will contain the following information:

- Sample identification number
- Date and time of collection
- Sample description
- Name of sampler
- Analysis to be performed
- On-site preservation

4.5 SAMPLE CUSTODY

After a sample is collected, the integrity of the sample, from collection to data reporting, must be ensured. The following chain-of-custody procedures will trace possession and handling of individual samples. The custody will be documented from the time of collection in the field through receipt by the independent analytical laboratory.

Each time a batch of samples is prepared for hand delivery or shipment to the laboratory, a chain-of-custody record will be completed and will accompany the shipment. Whenever

custody of the samples is transferred, the individual relinquishing and the individual receiving the samples will sign, date, and note the time on the form. The original form will accompany the shipment to the laboratory and, upon receipt, will be returned to the Project Manager to document that the chain was unbroken. A typical chain-of-custody form is shown in **Figure 4-2**. The chain-of-custody record will contain the following information:

- Name and address of facility
- Sample ID
- Signature of collector
- Date and time of collection
- Sample collection location
- Handling requirements
- Total number of samples
- Analysis to be conducted
- Individual assuming custody of shipment including date and time.

If a delivery or courier service is used to transport the samples, the bill of loading or receipt from the independent service will be maintained by the Project Manager to document custody for that segment of the sample transport.

4.6 PACKAGING, LABELING AND SHIPPING

When shipping samples to the laboratory, the following procedures will be used:

- The sample containers will be placed in a case, usually an ice chest. The contents within the ice chest will be cooled with ice to 4°C and filled with sufficient packing material to protect sample containers from breakage during shipment.

- The chain-of-custody record will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid.

- The cooler will be closed and taped shut with strapping tape.

•The cooler will be hand delivered to the analytical laboratory or handed to an overnight carrier after an air bill has been prepared. Any sample transported via overnight carrier will be labeled in accordance with Department of Transportation (DOT) regulations.

☐ e-Lab Analytical, Inc.
10450 Stancliff Rd. #210
Houston, Texas 77099
(Tel) 281.530.5656
(Fax) 281.530.5887

Chain of Custody Form

Page _____ of _____

The Chain of Custody is a Legal Document. All information must be completed accurately.

☐ e-Lab Analytical, Inc.
3352 128th Avenue
Holland, Michigan 49424
(Tel) 616.399.6070
(Fax) 616.399.6185

e-Lab Analytical Project Manager:		e-Lab Analytical Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name		A	
Work Order		Project Number		B	
Company Name		Bill To Company		C	
Send Report To		Invoice Attn.		D	
Address		Address		E	
				F	
City/State/Zip		City/State/Zip		G	
Phone		Phone		H	
Fax		Fax		I	
e-Mail Address				J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s): Please Print & Sign	Shipment Method:	Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other _____	Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Notes:

Relinquished by:	Date:	Time:	Received by (Laboratory):	e-Lab Analytical Cooler ID	Trip Blank Number	QC Package: (Check Box Below)	
						Level II: Standard QC	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			Level III: Standard QC + Raw Data	
						Level IV: SW846 Methods/CLP	
						Other: _____	

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to e-Lab Analytical, Inc.

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Each of the samples analyzed will be subjected to extensive quality control. Quality control procedures in the field will include sample handling and documentation protocols as described in Section 4. Techniques will be used in the field to avoid sample contamination and to adequately preserve each sample until it reaches the laboratory. All sampling equipment will be dedicated to each sample location.

Sampling personnel will wear disposable nitrile gloves while conducting sampling to reduce the possibility of cross contamination. Sample bottles will be laboratory pre-cleaned containers that meet cleaning QC requirements. Field duplicates will be collected of the *Wastewater Treatment Biosludge* on the third week to assess sample collection procedures. These field QA/QC procedures will ensure the integrity and representativeness of the sample.

Trip blanks, consisting of laboratory grade deionized water supplied by the laboratory, will be carried with the sample containers during sample collection. The purpose of the trip blanks is to determine the impact, if any, of ambient VOC concentrations in the plant during sampling activities. Two trip blanks will be analyzed with the biosludge samples. The trip blanks will be collected on the second and fourth weeks of sampling.

A field blank will be collected during Week 1 by filling two VOA vials with deionized water at biosludge filter press area. The field blank will also indicate if ambient volatile organics may interfere with the sample VOA data.

Additional quality control procedures will be employed in the laboratory. As a minimum, laboratory QA/QC procedures will be in accordance with the guidelines in Volume One, Chapter One of EPA document SW-846. Laboratory QA/QC including method blank analyses, surrogate spikes, calibration curves and dates of sample extraction and analysis.

Analytical precision, accuracy and method performance will be evaluated by the laboratory by comparing the QA/QC sample results (% recovery and relative percent difference) to allowable limits defined by the EPA analytical method. These parameters that are outside of the designated limits will be flagged by the laboratory and discussed in a narrative of inconsistencies and/or deviations from the QC requirements.

A summary of the QA/QC samples is shown in **Table 12.**

6.0 HEALTH AND SAFETY PROCEDURES

OxyChem adheres to a stringent safety program for its employees and contractors working in the VCM plant. The plant's health and safety program will be followed during sampling events. All sampling personnel will meet the OSHA 1910 requirements for working at industrial sites. This includes a minimum of 24 hours of safety training, 8 hours of refresher training annually and medical monitoring. Additionally, contractors working at the OxyChem plant will complete five hours of required general and plant specific orientation training prior to working at the plant.

Specific health and safety considerations during sampling include use of appropriate personal protective equipment and use of the buddy system. Personal protective equipment for this sampling effort will consist of the following:

- Hard hat
- Safety goggles
- Ear plugs (in high noise areas)
- Steel toed rubber or leather boots (rubber boots if there is a splashing potential)
- Acid resistant gloves
- Polycoated Tyvek (if there is a splashing potential)
- Flame retardant clothing

During each sampling event, the VCM plant Environmental Supervisor will be notified of the planned activities and when sampling personnel are in the VCM plant. Any accidents will be reported to the VCM shift supervisor.

Appendix A

Tables

TABLE 1

Hazardous Wastes Generated at OxyChem
Ingleside, Texas

Description	TCEQ Waste Code (a)	EPA Waste Code
Paint Thinner	0117211H	D001, D035, F003, F005
Oil, Hazardous*	0136206H	D001, D028, D040, F001, F002
VCM Heavy Ends*	0248219H, 0009202H, 0016202H, OUTS219H, 219H	D001, K019, K020
VCM Light Ends*	0251219H, OUTS219H, 219H	D001, F025
Mother Liquor*	0258219H	D001, K019, K020
EDC By-product (Heavy Ends)*	0339219H, 0009202H, OUTS219H	D001, K019
Lab Packs (Hazardous)	0075001H	D002, D007, D011, P098, U076, U080, U131, U228
Clean up of Fuel/ Lubrication Oil Spills	0106489H	D002, D040
Solvent Contaminated Material	0108407H	D040
Paint-Related Material	0133409H	D005, D007, D008, F003, F005
Waste Petroleum Naphtha	0134203H	D001, D018, D029, D039, D040
Unused Resin Material	0138219H	D001, D003
Unused Sealant/Tire Sealant	0139219H	D001, F003
Unused Varnish	0140209H	D001
Fuel Oil Contaminated Water	0177205H	D001, D018
Spent Carbon Canisters From Aerosol	0190404H	D040
Residue from Punctured Spray Cans	0192204H	D001, D040
Waste Resin Generated During Maintenance	0196409H	D001, F003,F005
Contaminated Cooling Tower Wood	0197488H	D004
Spent Carbon Contaminated w/ 1,2-Dichloroethane	0199404H	D028, U077
Reboiler Scale	0229407H	D007, D019, D022, D028, D032, D040
EDC Contaminated Material	0238319H	D028, U077
Solvent-Contaminated Solid Material (typically soil)	0241301H	D028, D043, K019, K020, U043, U077
Incinerator Ash	0242303H	F001, F003, F005, F025, K019, K020

TABLE 1 (continued)

Hazardous Wastes Generated at OxyChem
Ingleside, Texas

Description	TCEQ Waste Code (a)	EPA Waste Code
Incinerator Brick	0243319H	F001, F003, F005, F025, K019, K020
VCM Furnace Coke	0244407H	D001, D006, D007, D028, D043
Spent Copper Chloride Catalyst	0246393H	D028
Contaminated Sludge	0247319H	D028, D043, K019, K020, U077
Filter Wastes	0249310H	F025
Spent Carbon Contaminated w/ Vinyl Chloride	0250404H	D043
Limestone Sludge	0253306H	F001, F003, F005, F025, K019, K020
Rockbox Residue	0255319H	F001, F003, F005, F025, K019, K020
Absorbent Material from Rockbox Residue	0260310H	F001, F003, F005, F025, K019, K020
Dewatered Sludge	0275407H	F001, F003, F005, F025, K019, K020
Scale from Incinerator Flue	0289303H	F001, F003, F005, F025, K019, K020
Hazardous Wastewater at VCM	0293105H	D002, F001, F003, F025, K019, K020
Sandfilter Sand	0294319H	F003, F005, F025, K019, K020
Spiking Solution Contaminated Solids	0295319H	D007, D008
By-product Contaminated Materials	0301301H	K019
Solids from EDC process and wastewater tank cleanouts	0302319H	K019
Sulfate Purge Wastewater	0404110H	D002
Demister Elements	0405403H	D019, D022, D039, D040
Chlorinated Resin	0406609H	D002, D019, D022, D039, D040
Contaminated Plant Waste	0424310H	D019
Spent Phosphoric Acid	0479105H	D002
Suction Chiller Reboiler	0481407H	D034
Carbon Tetrachloride for solvent	0482202H	D002, D019, D034
Carbon Tetrachloride for Process	0483202H	D002, U211
Acid Tank Scale	0499319H	D002

TABLE 1 (continued)

Hazardous Wastes Generated at OxyChem
Ingleside, Texas

Description	TCEQ Waste Code (a)	EPA Waste Code
Natural gas used in CoGen Plant, has liquids entrained in the gas	0504219H	D009, D018
Waste mercury from spill cleanup	0135117H	D009
Reboiler scale	0229407H	D07, D019, D022, D028, D032, D040
Spiking solution contaminated solids	0295319H	D007, D008
Contaminated spent carbon from EDC tank cleanouts	0303404H	D028, K019
Used activated carbon removed from the chlorine recovery process	9158404H	D019, U211

NOTE:

(a) TCEQ = Texas Commission on Environmental Quality, Notice of Registration 2/21/06

* Wastes are incinerated onsite.

TABLE 2

Hazardous Waste Management Units
OxyChem
Ingleside, Texas

Hazardous Waste Management Unit	Waste Managed	Waste Code (a)
Chlor-Alkali Container Storage Area (Greater than 90 Day Storage) NOR Facility 6	Paint Thinner	0117211H
	Oil, Hazardous	0136206H
	VCM Heavy Ends	0248219H
	EDC Heavy Ends	0339219H
	Clean up of Fuel/ Lubrication Oil Spills	0106489H
	Solvent Contaminated Material	0108407H
	Paint-Related Material	0133409H
	Unused Resin Material	0138219H
	Unused Sealant/Tire Sealant	0139219H
	Unused Varnish	0140209H
	Fuel Oil Contaminated Water	0177205H
	Spent Carbon Canisters From Aerosol	0190404H
	Residue from Punctured Spray Cans	0192204H
	Waste Resin Generated During Maintenance	0196409H
	Reboiler Scale	0229407H
	EDC Contaminated Material	0238319H
	Solvent-Contaminated Solid Material	0241301H
	Incinerator Ash	0242303H
	Incinerator Brick	0243319H
	VCM Furnace Coke	0244407H
	Contaminated Sludge	0247319H
	Filter Wastes	0249310H
	Spent Carbon Contaminated w/ Vinyl Chloride	0250404H
	Absorbent Material from Rockbox Residue	0260310H
	Scale from Incinerator Flue	0289303H
	By-product Contaminated Materials	0301301H
	Chlorinated Resin	0406609H
	Contaminated Plant Waste	0424310H
	Spent Phosphoric Acid	0479105H
	Carbon Tetrachloride used as Solvent	0482202H
	Carbon Tetrachloride for Process	0483202H
	Acid Tank Scale	0499319H
VCM Limestone Sludge Container Storage Area (Greater than 90 day storage) NOR Facility 48	Limestone Sludge (a)	0253306H
Tanks C-720A/B Heavy and Light Ends Storage Tanks NOR Facilities 23/82 respectively	VCM Light Ends	0251219H, OUTS219H, 219H
	VCM Heavy Ends	0248219H, 0009202H, 0016202H, OUTS219H, 219H
	EDC Heavy Ends (By-product)	0339219H, 0009202H, OUTS219H

TABLE 2 (continued)

Hazardous Waste Management Units
OxyChem
Ingleside, Texas

Hazardous Waste Management Unit	Waste Managed	Waste Code (a)
Tank 6D-02 NOR Facility 81	EDC Heavy Ends (By-product)	0339219H, 0009202H, OUTS219H
VCM Container Storage Area	Paint Thinner	0117211H
(Greater than 90 Day Storage)	Oil, Hazardous	0136206H
NOR Facility 22	VCM Heavy Ends	0248219H
	EDC Heavy Ends	0339219H
	Clean up of Fuel/ Lubrication Oil Spills	0106489H
	Solvent Contaminated Material	0108407H
	Paint-Related Material	0133409H
	Unused Resin Material	0138219H
	Unused Sealant/Tire Sealant	0139219H
	Unused Varnish	0140209H
	Fuel Oil Contaminated Water	0177205H
	Spent Carbon Canisters From Aerosol	0190404H
	Residue from Punctured Spray Cans	0192204H
	Waste Resin Generated During Maintenance	0196409H
	Reboiler Scale	0229407H
	EDC Contaminated Material	0238319H
	Solvent-Contaminated Solid Material	0241301H
	Incinerator Ash	0242303H
	Incinerator Brick	0243319H
	VCM Furnace Coke	0244407H
	Contaminated Sludge	0247319H
	Filter Wastes	0249310H
	Spent Carbon Contaminated w/ Vinyl Chloride	0250404H
	Absorbent Material from Rockbox Residue	0260310H
	Scale from Incinerator Flue	0289303H
	By-product Contaminated Materials	0301301H
	Chlorinated Resin	0406609H
	Contaminated Plant Waste	0424310H
	Spent Phosphoric Acid	0479105H
	Carbon Tetrachloride used as Solvent	0482202H
	Carbon Tetrachloride for Process	0483202H
	Acid Tank Scale	0499319H
	Natural Gas with Entrained Liquids	0504219H

TABLE 2 (continued)

Hazardous Waste Management Units
OxyChem
Ingleside, Texas

Hazardous Waste Management Unit	Waste Managed	Waste Code (a)
Incinerators CCIN-1/CCIN-2 NOR Facilities 65/66 respectively	VCM Light Ends	0251219H, OUTS219H, 219H
	VCM Heavy Ends	0248219H, 0009202H, 0016202H, OUTS219H, 219H
	EDC Heavy Ends (By-product)	0339219H, 0009202H, OUTS219H
	Oil, Hazardous	0136206H
	Spent Paint Thinner	0117211H
	Mother Liquor	0258219H

NOTE:
(a) Refer to Table 1 for EPA waste code designations

TABLE 3

VCM and Former EDC Unit Liquid Wastes
OxyChem
Ingleside, Texas

Components based on Annual Waste Analysis 1998-2005	VCM Plant Heavy Ends	VCM Plant Light Ends	Former EDC Unit Heavy Ends (a)
Volatile Organics			
Benzene (mg/Kg)	1000	3,500 – 8,000	ND
Chlorobenzene (mg/Kg)	300-12,000	ND	ND
Carbon Tetrachloride (mg/Kg)	300-19,000	50,000-380,000	ND
Chloroform (mg/Kg)	3,000-84,000	54,000-750,000	11,000
1,1,2,2,-Tetrachloroethane (mg/Kg)	700-26,000	ND	ND
Trichloroethene (mg/Kg)	12,000	35,000 – 78,000	ND
1,1,2-Trichloroethane (mg/Kg)	7,500-280,000	ND	73,000-110,000
1,1-Dichloroethane (mg/Kg)	500-19,000	56,000-150,000	ND
1,1 Dichloroethene (mg/Kg)	ND	3,000 – 49,000	ND
1,2-Dichloroethane (EDC) (mg/Kg)	12,000-300,000	28,000-630,000	160,000-380,000
Chloroethane (mg/Kg)	ND	8,000-32,000	ND
Tetrachloroethene (mg/Kg)	1,600-42,000	ND	ND
cis-1,2 Dichloroethene (mg/Kg)	300	4,000-61,000	ND
Trans-1,2 Dichloroethene (mg/Kg)	ND	4,200	ND
Vinyl Chloride (mg/Kg)	ND	5,200	ND
Semi-Volatile Organics			
bis(2-chloroethyl)ether (mg/Kg)	3,600-8,500	ND	30,000-56,000
1,3-Dichlorobenzene (mg/Kg)	680	ND	ND
1,4-Dichlorobenzene (mg/Kg)	470	ND	ND
Naphthalene (mg/Kg)	750 - 1100	ND	ND
Hexachlorobutadiene (mg/Kg)	230	ND	ND
Hexachloroethane (mg/Kg)	260	ND	ND
All other semivolatiles	ND	ND	ND
Metals			
Arsenic (ppm)	<1.0	<1.0	<5.0
Barium (ppm)	<1.0	<1.0	<5.0
Cadmium (ppm)	<1.0	<1.0	<5.0
Chromium (ppm)	1.0-6.0	0.7-<5	<5.0
Lead (ppm)	<5.0 – 7.0	<1.0	<5.0
Mercury (ppm)	0.1	<0.5	<0.5
Selenium (ppm)	<0.0005-7	<0.005-11	<5.0-15
Silver (ppm)	<0.5	<0.5	<5.0
Parameters			
Total Organic Halides (mg/Kg)	130,000-830,000	410,000-920,000	400,000-740,000
Ash Content (% by wt)	<0.02-0.06	<0.02-0.05	<0.02-0.22
Higher Heating Value (Btu/lb)	5,000 - 18,720	3,700 – 5,214	6,894

Notes:

(a) Former EDC unit idled in 2002. Annual waste analysis data is for 1998-2000.

TABLE 3 (Continued)

VCM and Former EDC Unit Liquid Wastes (b)
OxyChem
Ingleside, Texas

Components Based on Trial Burn Data (10-15-02 through 10-18-02)	VCM Plant Heavy Ends	VCM Plant Light Ends	Former EDC Unit Heavy Ends
Volatile Organics			
Vinyl chloride monomer (wt %)	--	0-5	–
Carbon Tetrachloride (wt %)	–	0-15	–
Chloroform (wt %)	0-5	0-100	--
Chloroethane (wt %)	–	0-10	–
1,1,2,2,-tetrachloroethane (wt %)	5-25	–	--
Trichloroethylene (wt %)	0-2	0-5	–
1,1,1- trichloroethane (wt%)	0-5		
1,1,2-trichloroethane (wt %)	0-90	--	5-30
1,1-dichloroethane (wt %)	–	0-30	–
1,2-dichloroethane (wt %)	10-100	0-100	10-50
Chloroprene (wt %)	–	0-15	–
Tetrachloroethylene (wt %)	0-15	–	5-25
Chlorobenzene (wt%)	0-5	-	-
1,2-dichloroethylene (wt %)	–	0-20	–
2-Chloroethanol (wt %)	0-2	–	–
Ethylene (wt %)	–	0-3	–
Bis(2-chlorethyl)ether (wt%)	0-30	-	1-5
Heavier Compounds (c) (wt %)	30-60	--	25-50
Metals			
Arsenic (ppm)	2	2	2
Cadmium (ppm)	5	5	1
Chromium (ppm)	11.3	1	1
Lead (ppm)	20	5	5.3
Mercury (ppm)	0.2	0.1	0.1
Selenium (ppm)	5	5	1
Iron (ppm)	200-2000	-	-
Parameters			
Ash Content (ppm)	0-1200	0-750	0-750
Higher Heating Value (Btu/lb)	5,000-6,200	5,000-6,500	5,000-6,200
Chlorine (wt%)	65-90	65-90	65-90
Average Production Rate (lb/hr)	6,400	1000	140
Density (lb/gal)	10-12	10-11	10-11

NOTES:

(b) Analyses from Trial Burn Results, Ccmprehensive Performance Test Report, Occidental Chemical, Ingleside, Texas,
Revision 0 , July 25, 2003

(c) Primarily chlorinated butanes and butanes.

TABLE 4

Mother Liquor Waste [a]
OxyChem
Ingleside, Texas

Components	*Concentrations Ranges/Features*
Composition:	
1,2-Dichloroethane (wt%)	40-60
Trichloroethane	4,000 mg/Kg
Hexachlorobenzene	1,100 mg/Kg
Arsenic (ppm)	--
Cadmium (ppm)	4
Chromium (ppm)	10
Lead (ppm)	--
Mercury (ppm)	--
Selenium (ppm)	--
Heavier Compounds [b] (wt%)	30-60
Iron (ppm)	30,000-50,000
Chlorine (wt%)	65-75
Parameters:	
Physical Description	Liquid
Ash Content (ppm)	9,600-100,000
Higher Heating Value (BTU/lb)	5,000-6,000
Density (lb/gal)	11-12
Specific Gravity (unitless)	1.365

NOTE:

[a] Analyses from Trial Burn Results, Comprehensive Performance Test Report, Occidental Chemical, Ingleside, Texas, Revision 0 , July 25, 2003 and annual sampling on 12/1/04.

[b] Primarily chlorinated butanes and butenes.

TABLE 5

Hazardous Waste Oil[a]
OxyChem
Ingleside, Texas

Components	*Concentrations Ranges/Features*
Composition:	
Oil (wt%)	>95
1,1,1-trichloroethane (wt%)	0-5
1,2 -dichloroethane (wt%)	0-5
Arsenic (ppm)	--
Cadmium (ppm)	--
Chromium (ppm)	--
Lead (ppm)	--
Mercury (ppm)	--
Selenium (ppm)	--
Chlorine (wt%)	<1
Zinc (ppm)	<1
Parameters	
Physical Description	Liquid
Ash Content (ppm)	4,000-30,000
Higher Heating Value (BTU/lb)	10,000-20,000
Density (lb/gal)	7.2-7.6

NOTE:

[a] Analyses from Trial Burn Results, Occidental Chemical, Ingleside, Texas, Revision, June 7, 2002.

Table 6
Composition of VCM Heavy Ends, VCM Light Ends and EDC Heavy Ends

Parameter	Units	Ingleside[1]	La Porte[2]	Deer Park V-477[3]	Ingleside (OxyMar)[4]		La Porte[4]		Ingleside[4]		Convent[4]	
		Light Ends	Light Ends	VCM Heavy Ends	VCM Heavy Ends		VCM Heavy Ends		EDC Heavy Ends		EDC Heavy Ends	
				% Composition	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Antimony	ppm	--	--	--	<8	<10	<1	<1	--	--	<6.2	<6.2
Arsenic	ppm	<1	--	--	<1.0	<2	<0.5	<0.5	<1	<1	<0.38	<0.38
Beryllium	ppm	<0.5	--	--	<0.6	<2	<0.05	<0.05	--	--	<0.05	<0.05
Cadmium	ppm	<1	--	--	<1.4	<5	<0.25	<0.25	<2	<2	<0.78	<0.78
Chromium	ppm	<1	--	0.88	11.3	17	0.588	0.588	<4	<4	<1.2	<1.2
Cobalt	ppm	--	--	--	<8	<8	<0.25	<0.25	--	--	<1	<1
Copper	ppm	--	--	3.16	--	--	--	--	--	--	--	--
Iron	ppm	--	--	91.3	--	--	--	--	--	--	--	--
Lead	ppm	<1	--	--	<5	<20	1	1	5.3	29	<0.15	<0.15
Manganese	ppm		--	0.44	<4	<4	2.22	2.22	--	--	--	--
Mercury	ppm	<0.	--	--	<0.14	<0.25	<0.1	<0.1	<0.25	<0.25	<0.05	<0.05
Nickel	ppm		--	1.33	<8	<8	0.42	0.42	--	--	<1.6	<1.6
Selenium	ppm	<1	--	5.38	<3	5	6.06	6.06	<0.5	<0.5	<0.45	<0.45
Sodium	ppm	--	--	104	--	--	--	--	--	--	--	--
Thallium	ppm	--	--	0.72	--	--	--	--	--	--	--	--
Benzene	wt%	0.7	--	0.0000005	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	wt%	<0.01	--	4.11	3.44	30	0.0567	0.0567	5	8.1	13	13
Carbon Tetrachloride	wt%	38	25-40		0.000228	0.000228	9.37	9.37	--	--	--	--
Chlorobenzene	wt%	<0.5	--	1.12 to 2.0	0.000614	5	5.3	5.3	--	--	--	--
Chloroethane	wt%	1.3	1-5	--	--	--	1.61	1.61	--	--	--	--
Chloroethanol, 2-	wt%	--	--	--	2	2	--	--	--	--	--	--
Chloroform	wt%	0.7	25-40	6	0.00268	5	9.63	9.63	--	--	--	--
Chloronaphthalene, 2-	wt%	<0.01	--	0.00000057	--	--	--	--	--	--	--	--
Chloroprene	wt%	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, 4-	wt%	--	--	0.000000515	--	--	--	--	--	--	--	--
Dichlorobenzene, 1,2-	wt%	<0.01	--	0.09 to 0.12	--	--	--	--	--	--	--	--
Dichlorobenzene, 1,3-	wt%	<0.01	--	0.03 to 0.04	--	--	--	--	--	--	--	--
Dichlorobenzene, 1,4-	wt%	<0.01	--	0.11 to 0.17	--	--	--	--	--	--	--	--
Dichloroethane, 1,1-	wt%	4.9	1-10	--	--	--	1.79	1.79	--	--	--	--
Dichloroethane, 1,2-	wt%	56	10-25	24.8 to 38.3	10	100	23.6	23.6	0.0396	50	22	22
Dichloroethylene, 1,1-	wt%	<0.05	0-2	--	0.000069	0.000069	0.39	0.36	--	--	--	--

Table 6
Composition of VCM Heavy Ends, VCM Light Ends and EDC Heavy Ends

Parameter	Units	Ingleside[1]	La Porte[2]	Deer Park V-477[3]	Ingleside (OxyMar)[4]		La Porte[4]		Ingleside[4]		Convent[4]	
		Light Ends	Light Ends	VCM Heavy Ends	VCM Heavy Ends		VCM Heavy Ends		EDC Heavy Ends		EDC Heavy Ends	
				% Composition	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Dichloroethylene, 1,2-	wt%	--	0.5-5	--	--	--	--	--	--	--	--	--
Dichloroethylene, 1,2-, cis-	wt%	<0.5	--	--	0.0000126	0.0000126	0.92	0.92	--	--	--	--
Dichloroethylene, 1,2-, trans-	wt%	<0.5	--	--	--	--	0.891	0.891	--	--	--	--
Dichloropropane, 1,3-	wt%	<0.5	--	0.1	--	--	0.0575	0.0575	--	--	--	--
Dichloropropene, 1,2-, trans-	wt%	--	--	0.00000055	--	--	--	--	--	--	--	--
Ethylene	wt%	--	--	--	--	--	--	--	--	--	--	--
Fluorene	wt%	0.01	--	0.00000075	--	--	--	--	--	--	--	--
Hexachloro- 1,3-butadiene	wt%	<0.01	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	wt%	<0.01	--	--	--	--	0.16	0.16	--	--	--	--
Hexachloroethane	wt%	<0.01	--	0.02	--	--	1.01	1.01	0.0268	0.0268	0.039	0.039
Methylnaphthalene, 2-	wt%	<0.01	--	--	--	--	--	--	--	--	0.088	0.088
Naphthalene	wt%	<0.01	--	0.05	--	--	--	--	--	--	0.07	0.07
Pentachlorobenzene	wt%	--	--	--	--	--	0.0915	0.0915	--	--	--	--
Phenanthrene	wt%	0.01	--	0.00000028	--	--	--	--	--	--	--	--
Styrene	wt%	<0.5	--	0.05	0.0000265	0.0000265	--	--	--	--	--	--
Tetrachlorobenzene, 1,2,4,5-	wt%	--	--	--	--	--	0.0683	0.0683	--	--	--	--
Tetrachloroethane, 1,1,1,2-	wt%	--	--	0.25	--	--	--	--	--	--	--	--
Tetrachloroethane, 1,1,2,2-	wt%	<0.5	--	1.42 to 2.36	5	25	3.85	3.85	--	--	--	--
Tetrachloroethylene	wt%	<0.5	--	1.7 to 2.97	0.00245	15	3.15	3.15	5	25	--	--
Trichlorobenzene, 1,2,4-	wt%	<0.01	--	0.01	--	--	--	--	--	--	--	--
Trichloroethane, 1,1,1-	wt%	<0.5	--	--	0.0000417	5	--	--	--	--	--	--
Trichloroethane, 1,1,2-	wt%	<0.5	0.1-5	13.3 to 37.2	0.0212	90	38.6	38.6	0.0181	30	6.2	6.2
Trichloroethylene	wt%	6.6	0.1-0.5	0.05	0.000196	2	--	--	--	--	--	--
Trichloropropane, 1,2,3-	wt%	<0.5	--	0.39	--	--	--	--	--	--	--	--
Vinyl Chloride	wt%	<0.5	0.5-2	--	0.0000587	0.0000587	0.583	0.583	--	--	--	--

Notes:

1. Sample collected 11/7/05
2. Data from MSDS
3. Samples collected 11/25/98, 1/28/99, 2/14/00, and 1999 Trial Burn (3 samples), also 3 samples for metals
4. Samples collected in 2000 for HWC MACT tests

TABLE 7

Volume of Waste Incinerated **(a)**
OxyChem
Ingleside, Texas

Waste Type	2002 (Tons)	2003 (Tons)	2004 (Tons)	2005 (Tons)
Former EDC Unit Heavy Ends	0	0	0	0
VCM Plant Heavy Ends	23,024	20,272	41,869	40,792
VCM Plant Light Ends	1314	166	280	220
Mother Liquor	0	0	0	0
Waste Oil	0	0	0	0
TOTAL LIQUID FEED	**24,338**	**20,438**	**42,149**	**41,012**
Process Vent Gases	Mscfm	Mscfm	Mscfm	Mscfm
All three incinerators	686,587	651,078	730,008	690,458

NOTES:

(a) Based on Annual Waste Summary Reports and Process Record

TABLE 8

Maximum Concentration of Constituents Detected
January Through March 2006
Wastewater Treatment Biosludge
OxyChem
Ingleside, Texas

Constituent	Wastewater Treatment Biosludge (mg/Kg) TOTAL	Wastewater Treatment Biosludge (mg/L) TCLP	EPA Delisting Level (mg/Kg) TOTAL	EPA Delisting Level (mg/L) TCLP
Volatile Organics				
Methylene Chloride	0.009	0.044	101	8.39
Benzoic Acid	0.32	0.108	5.00E+08	559
Acetone	3.34	0.67	1.25E+07	14.8
Methyl Ethyl Ketone	0.20	0.028	1,310	88.6
Vinyl Acetate	0.008	<0.005	150	140
1.3-Dichloropropene	<0.008	0.0038	64.2	0.272
Chloroform	22.0	<0.005	8.66E+05	4.46
1,2-Dichloroethane	0.015	<0.005	8.62	0.0103
Trichloroethylene	0.005	<0.005	187	0.886
Metals				
Arsenic	9.7	0.006	26,200	0.0194
Barium	33.1	2.12	9.23E+05	15.1
Beryllium	1.6	<0.02	36,900	1.62
Chromium	22	0.008	8.66E+05	44,900
Cobalt	1.0	0.768	7.49E+06	--
Copper	91	0.43	5.00E+06	2,180
Iron	1,160	1.0	3.75E+07	--
Lead	4.0	<0.5	4.43E+05	--
Magnesium	<500	3.2	--	--
Manganese	222	1.70	92,300	--
Mercury	0.032	<0.002	0.153	0.0579
Nickel	71	0.34	2.04E+05	5.85
Thallium	<0.05	**0.852**	1.79E+02	**0.0273**
Vanadium	24.3	<0.05	8.74E+05	4.37
Zinc	92.8	2.14	1.44E+06	58
Dioxins/Furans				
2,3,7,8 TCDD Equivalent	1.23E-03	1.21E-08	7.37E-01	1.81E-07
Semi-Volatile Analyses				
Bis(2-ethylhexyl)phthalate	0.23	<0.01	4031E+05	2.95
Hexachlorobenzene	0.18	<0.01	42.9	0.0170

Notes: All other Appendix IX volatiles, semivolatiles and PCBs were less than detection limts. DRAS Version 2.0 run using 3,689 cy x 20 years, 10^{-05} Risk and HI 1.0. Some Delisting Levels exceed saturation concentrations (not corrected).

TABLE 9

Basis-for-Listing Hazardous Waste
40 CFR 261, Appendix VII
OxyChem
Ingleside, Texas

F001
- Tetrachloroethylene
- Methylene chloride
- Trichloroethylene
- 1,1,1-Tichloroethane
- Carbon tetrachloride
- Chlorinated fluorocarbons

F003
- N.A.

F005
- Toluene
- Methyl ethyl ketone
- Carbon Disulfide
- Isobutanol
- Pyridine
- 2-Ethoxyethanol
- Benzene
- 2-Nitropropane

F025
- Chloromethane
- Dichloromethane
- Trichloromethane
- Carbon tetrachloride
- Chloroethylene
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- trans-1,2-Dichloroethylene
- 1,1,-Dichloroethylene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethylene
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2-Tetrachloroethane
- Pentachloroethane
- Tetrachloroethylene
- Hexachloroethane

F025 (Continued)
- 3-Chloropropene
- Dichloropropane
- Dichloropropene
- 2-Chloro-1,3-Butadiene
- Hexachloro-1,3-Butadiene
- Hexachlorocyclopentadiene
- Benzene
- Chlorobenzene
- Dichloroenzene
- 1,2,4-Trichlorobenzene
- Tetrachlorobenzene
- Pentachlorobenzene
- Hexachlorobenzene
- Toluene
- Naphthalene

K019/K020
- Ethlyene dichloride
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2-Tetrachloroethane
- Trichloroethylene
- Tetrachloroethylene
- Carbon Tetrachloride
- Chloroform
- Vinyl chloride
- Vinylidene chloride

TABLE 10

Target Compounds for Waste Characterization – *Wastewater Treatment Biosludge (Total and TCLP Basis)*
OxyChem
Ingleside, Texas

Parameter	EPA Method (a)	Total Basis	TCLP Basis
Appendix IX Constituents			
Appendix IX Volatiles	8260A	X	X
Appendix IX Semivolatiles	8270B	X	X
Appendix IX Metals /Mercury	6020/7470	X	X
Appendix IX Organophosphorus Pest. (one sample only)	8081	X	X
Appendix IX Organochlorine Pest. (one sample only)	8141	X	X
Appendix IX Herbicides (chlorinated) (one sample only)	8151A	X	X
Appendix IX PCBs (one sample only)	8082	X	X
Appendix IX Dioxins/Furans	1613B	X	X
Hazardous Waste Characteristics/Other			
Total Cyanide	9010	X	
Total Sulfide	9030A	X	
Total Oil and Grease	1664	X	
Percent Moisture	160.3	X	
Toxicity Characteristic Leaching Procedure	1311		X
TCLP Extraction for metals at pH 3, 5, 10 (b)	6020/7470		X

Notes:
(a) Test Methods for Evaluating Solid Waste-Physical and Chemical Methods, EPA SW-846; and Methods of Analysis of Water and Waste, EPA-600/4-79-020.
See **Appendix F** "Multiple pH Test Protocol"

TABLE 11

Sample Containers, Preservation and Holding Times
Wastewater Treatment Biosludge
OxyChem
Ingleside, Texas

Analysis	Sample Type	Sample Size/Container (Plastic/Glass)	Preservation	Holding Time
Volatiles	Sludge	2 x 2 oz. glass	Cool to 4°C	14 days
Semivolatiles	Sludge	4 x 32 oz. glass	Cool to 4°C	14/40 (a)
Pesticides/Herbicides/PCBs	Sludge	with semivolatiles	Cool to 4°C	14/40 (a)
Oil and Grease	Sludge	with semivolatiles	Cool to 4°C	28 days
Total Sulfide	Sludge	with semivolatiles	Cool to 4°C	14 days
Total Cyanide	Sludge	with semivolatiles	Cool to 4°C	14 days
Dixons/Furans	Sludge	3 x 32 oz. glass	Cool to 4°C	1 year/40 days (b)
Metals (including volume to run TCLP extractions at pH3, pH5 and pH10) ***(Week one sample only)***	Sludge	2 x 32 oz. glass	Cool to 4°C	6 months except mercury (28 days)
TCLP extraction for App. IX VOAs, SemiVOAs, and Dioxin/Furans ***Pest/Herb/PCBs (on one sample)	Sludge	5 x 32 oz. glass	Cool to 4°C	TCLP extraction within 14 days of collection.

Notes:

(a) 14 days to extract and 40 days to analyze once extracted.

(b) Metals will be extracted using Method 1311 and the Multiple pH Testing Procedures in **Appendix F**. The laboratory generally extracts the sample within 14 days to provide standard turnaround time.

TABLE 12

Proposed QA/QC Samples
OxyChem
Ingleside, Texas

QA/QC Sample	Week	Wastewater Treatment Biosludge
Field Samples:		
Field Blank	Week 1	X
Trip Blank	Weeks 2 and 4	X
Multiple pH extraction (pH 3, 5, 10)	Week 1	X
Duplicate	Week 3	X
Laboratory Samples:		
Duplicates	Weeks 1-4	X
Spikes	Weeks 1-4	X
Surrogate Spikes	Weeks 1-4	X
Method Blanks	Weeks 1-4	X

Appendix B
MSDS Sheets for Raw Materials Used in VCM Process

AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT AND COMPANY INFORMATION

CHEMICAL NAME; CLASS: OXYGEN

SYNONYMS: Oxygen USP, Aviator's Breathing Oxygen (ABO)
CHEMICAL FAMILY NAME: Oxidizing Gas
FORMULA: O_2

NOTE: Oxygen may be supplied by pipeline at pressures up to 600 PSIG.

	Document Number: 10074
PRODUCT USE:	Medical, welding and general analytical or synthetic chemical uses.
MANUFACTURED/SUPPLIED FOR:	AIR LIQUIDE
ADDRESS:	2700 Post Oak Drive Houston, TX 77056-8229
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	
General MSDS Information	1-713/896-2896
Fax on Demand:	1-800/231-1366

2. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Oxygen is a colorless, odorless gas. The main health hazard associated with releases of this gas is its powerful oxidizing power. In high oxygen content atmospheres, common combustible materials can become highly flammable. Emergency responders must practice extreme caution when approaching oxygen releases because of the extreme fire potential.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: High concentrations (80% or more) of this gas can cause an oxygen-rich environment. Individuals breathing such an atmosphere for durations of 17-24 hours may experience symptoms which include nasal stuffiness, nausea, dizziness, bronchial irritation (cough), sore throat, hypothermia, increased depth of respiration, bradycardia, pulmonary discomfort (including chest pain), peripheral vasoconstriction, amblyopia (loss of vision). Inhalation of pure oxygen at atmospheric pressure or less can cause pulmonary irritation and edema after 24 hours.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to Oxygen may cause the following health effects:

ACUTE: Individuals breathing oxygen-enriched atmospheres may experience nasal stuffiness, nausea, dizziness, coughing, sore throat, hypothermia, disturbed breathing, chest pain, and loss of vision.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this gas.

TARGET ORGANS: Respiratory system.

3. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Oxygen	7782-44-7	99.5%	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5% and below 23.5%					
Maximum Impurities		<0.5%	None of the trace impurities in this product contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalents standards.					

This material is classified as hazardous under OSHA regulations in the United States and the WHMIS in Canada.

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used.

NOTE: all WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-2004 format.

4. FIRST-AID MEASURES

Remove victim(s) to fresh air, as quickly as possible, or if in elevated pressures, reduce oxygen pressure to 1 atmosphere. Physician should be advised of victim's exposure to a high oxygen concentration. Trained personnel should administer medical aid such as cardio-pulmonary resuscitation, if necessary. Supplemental oxygen is not normally appropriate. Victims tend to recover rapidly, when removed from the hypoxic exposure.

Take copy of label and MSDS to physician or other health professional with victim(s). Medical care providers should refer to Section 11 (Toxicology Information) of this MSDS for additional information.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Oxygen does not burn; however, cylinders, when involved in fire, may rupture or burst in the heat of the fire. Oxygen will support and accelerate combustion. Common combustible materials will burn more readily in elevated oxygen environments, and some materials which are non-combustible in air will burn in an oxygen-enriched atmosphere. Direct water onto cylinders to keep cool. Shut-off the flow of oxygen or move cylinders from fire area if it can be done safely. Rescue personnel should be aware of the extreme fire hazards associated with oxygen-enriched atmospheres.

Water Spray: YES Carbon Dioxide: YES Foam: YES
Halon: YES Dry Chemical: YES Other: Any "ABC" Class.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Other information for pre-planning can be found in the North American Emergency Response Guidebook.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, eliminate sources of ignition, and respond with trained personnel. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be **Level B: fire protective clothing, mechanically-resistant, fire protective gloves and Self-Contained Breathing Apparatus**. In general, **DO NOT ENTER AN AREA IF THE OXYGEN CONTENT EXCEEDS 23.5%. USE VENTILATION TO REDUCE THE OXYGEN LEVELS.** Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Remove sources of heat, ignition, and, if possible, separate combustibles from the leak. Monitor the surrounding area for oxygen levels.

If leaking incidentally from the cylinder or its valve, contact your supplier.

7. HANDLING AND STORAGE

STORAGE AND HANDLING PRACTICES: Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Cylinders should be separated from flammable materials by a minimum distance of 20 ft or by a barrier of non-combustible material at least 5 ft high, having a fire resistance rating of at least ½ hour. Protect cylinders against physical damage. Isolate from other non compatible chemicals (refer to Section 10, Stability and Reactivity). Post "No Smoking or Open Flames" signs in storage or use areas.

Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers).

SPECIAL PRECAUTIONS FOR USE OF OXYGEN: All gauges, valves, regulators, piping and equipment to be used in oxygen service must be cleaned for oxygen service in accordance with CGA pamphlet G-4.1 Use piping and equipment adequately designed to withstand pressures to be encountered. Oxygen is not to be used as a substitute for compressed air. Never use an oxygen jet for cleaning purposes of any sort, especially clothing, as it increases the likelihood of an engulfing fire. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow. Never tamper with pressure relief valves and cylinders.

Personnel who have been exposed to high concentrations of oxygen should stay in a well-ventilated or open area for 30 minutes before going into a confined space or near an ignition source. Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion-proof

Keep the smallest amount necessary on-site at any one time. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Leak-check system with leak detection solution, never with flame. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of and electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information, refer to American National Standards (ANSI) Z49.1 *Safety in Welding and Cutting* published by the American Welding Society, PO Box 351040, Miami, FL 33135; National Fire Protection Association (NFPA) 51. See Section 16, (Other Information) for additional pamphlets developed by the Compressed Gas Association (CGA).

7. HANDLING AND STORAGE (Continued)

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, DO NOT USE ADAPTERS:

THREADED:	0-3000 psig	CGA 540
	3001-4000 psig	CGA 577
	4001-5500 psig	CGA 701
PIN-INDEXED YOKE:	0-3000 psig	CGA 870 (Medical Use)
ULTRA HIGH INTEGRITY:	0-3000 psig	714

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents dispersion of this gas into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of oxygen.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% and below 23.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5%. DO NOT ENTER AN AREA IF THE OXYGEN CONTENT EXCEEDS 23.5%.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: Wear gloves when handling cylinders of this product. Otherwise, wear glove protection appropriate to the specific operation for which this product is used.

BODY PROTECTION: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 0°C (32°F) and 1 atm: 0.083 lb/cu ft (1.326 kg/m^3)

BOILING POINT: -183.0°C (-297.4°F)

FREEZING/MELTING POINT @ 10 psig: -218.8°C (-361.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.105

pH: Not applicable.

SOLUBILITY IN WATER vol/vol at 0°C and 1 atm: 0.04.91

MOLECULAR WEIGHT: 32.00

EVAPORATION RATE (nBuAc = 1): Not applicable.

EXPANSION RATIO: Not applicable.

ODOR THRESHOLD: Not applicable.

VOLUME (ft^3/lb): 12.1

VAPOR PRESSURE @ 21.1°C (70°F) psig: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

APPEARANCE AND COLOR: This product is a colorless, odorless gas at normal temperature and pressure.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this product. An oxygen monitor can be used to detect oxygen levels.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: None.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Oxygen is incompatible with combustible and flammable materials, chlorinated hydrocarbons, hydrazine, reduced boron compounds, ethers, phosphine, phosphorous tribromide, phosphorous trioxide, tetrafluorethylene, and compounds which readily form peroxides. Oxygen may form explosive compounds when exposed to combustible material, or oil, grease, and other hydrocarbon materials.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Oxygen is the vital element in the atmosphere in which we live and breathe. The atmosphere contains approximately 21% oxygen. Breathing higher concentrations could lead to oxygen toxicity and pneumonia. Breathing lower oxygen concentrations could lead to hypoxia. The following toxicity data are for oxygen:

Human toxicological data and teratogenic data are available for Oxygen; however, the effects have occurred after prolonged exposure to Oxygen (inhalation effects of TCLo after 14 hours) and with exposure of very high concentration of Oxygen at greater than normal atmosphere.

Premature infants exposed to high oxygen concentrations may suffer delayed retinal damage which can progress to retinal detachment and blindness. Retinal damage may also occur in adults exposed to 100% oxygen for extended periods of time (24 to 48 hours).

At two or more atmospheres, central nervous system (CNS) toxicity occurs. Symptoms include nausea, vomiting, dizziness or vertigo, muscle twitching, vision changes, and loss of consciousness and generalized seizures. At three atmospheres, CNS toxicity occurs in less than two hours, and at six atmospheres in only a few minutes.

SUSPECTED CANCER AGENT: Oxygen is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC; therefore it is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: None.

SENSITIZATION OF PRODUCT: Oxygen is not a sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Oxygen on the human reproductive system.

Mutagenicity: Mutation data have been reported for oxygen; these data have been obtained in studies exposing specific animal tissues to relatively high concentrations (80%) of oxygen.
Embryotoxcity: Oxygen is not expected to cause embryotoxic effects in humans. For further information see following paragraph.
Teratogenicity Human teratogenic effects have been reported after inhalation of 12 pph oxygen for 10 minutes during 26-29 weeks of pregnancy; these effects include developmental abnormalities of the fetal cardiovascular system; Exposure of pregnant hamsters to 3-4 atmospheres of 100% oxygen for periods of 2-3 hours produced teratogenic effects in a small, but significant number of fetuses. One quarter of the mother hamsters developed central nervous system symptoms.
Reproductive Toxicity: Oxygen is not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this product. Persons with chronic obstructive pulmonary disease can retain carbon dioxide abnormally. If oxygen is administered to such persons, raising the oxygen concentration in the blood depresses the breathing rate and raises the retained carbon dioxide levels in the blood to a dangerous level in these persons.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure. Symptoms of over-exposure usually are relieved quickly. Immediate sedation and anticonvulsive therapy should be provided, as needed.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for this compound.

ADDITIONAL NOTES TO PHYSICIANS: Animal studies suggest that the administration of certain drugs, including phenothiazine drugs and chloroquine, increase the susceptibility to toxicity from oxygen at high pressures. Animal studies also indicate that vitamin "E" deficiency may increase susceptibility to toxicity to oxygen toxicity.

Airway obstruction during high oxygen tension may cause alveolar collapse following absorption of the oxygen. Similarly, occlusion of the Eustachian tubes may cause retraction of the eardrum and obstruction of the paranasal sinuses may produce "vacuum-type" headache. All individuals exposed for long periods to oxygen at high pressure and who exhibit overt oxygen toxicity should have ophthalmologic examinations.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Oxygen occurs naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No adverse effect is anticipated to occur to animal or plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors, away from all sources of ignition.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Oxygen, compressed
HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1072
PACKING GROUP:	Not applicable.
DOT LABEL(S) REQUIRED:	Non-Flammable Gas, Oxidizer or Oxygen

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 122

MARINE POLLUTANT: Oxygen is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Oxygen is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act. This product is subject to the reporting requirements of Sections 311 and 312 of Title III of the Superfund Amendments and Reauthorization Act (40 CFR 370.21).

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL INVENTORY STATUS: Oxygen is listed on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Oxygen is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS:

- Oxygen USP is regulated by the FDA as a prescription drug.
- Depending on specific operations involving the use of this product, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Oxygen is not listed in Appendix A.
- Oxygen does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Oxygen is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical.

CALIFORNIA PROPOSITION 65: Oxygen is not on the California Proposition 65 lists.

15. REGULATORY INFORMATION (Continued)

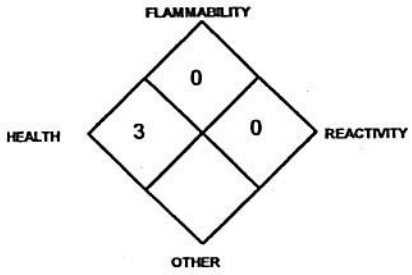
U.S. STATE REGULATORY INFORMATION: Oxygen is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: No.
California - Permissible Exposure Limits for Chemical Contaminants: No.
Florida - Substance List: Oxygen.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: No.
Missouri - Employer Information/Toxic Substance List: No.
New Jersey - Right to Know Hazardous Substance List: Oxygen.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Oxygen.
Rhode Island - Hazardous Substance List: Oxygen.
Texas - Hazardous Substance List: No.
West Virginia - Hazardous Substance List: No.
Wisconsin - Toxic and Hazardous Substances: No.

OTHER CANADIAN REGULATIONS: Oxygen is categorized as a Controlled Product, Hazard Classes A, and C as per the Controlled Product Regulations.

16. OTHER INFORMATION

NFPA RATING



HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	3
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
See Section 8			

For Routine Industrial Use and Handling Applications

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death. Further information about oxygen can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road 5th floor, Chantilly, VA 20151-2923. Telephone: (703) 788-2700.

G-4	*"Oxygen"*
G-4.1	*"Cleaning Equipment of Oxygen Service"*
G-4.3	*"Commodity Specification for Oxygen"*
G-4.4	*"Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems"*
G-4.6	*"Oxygen Compressor Installation Guide"*
P-1	*"Safe Handling of Compressed Gases in Containers"*
P-14	*"Accident Prevention in Oxygen-Rich and Oxygen Deficient Atmospheres"*
SB-7	*"Rupture of Oxygen Cylinders in the Diving Industry"*
SB-8	*"Use of Oxy-fuel Gas Welding and Cutting Apparatus"*
AV-1	*"Safe Handling and Storage of Compressed Gases"*
AV-8	*"Characteristics and Safe Handling of Cryogenic Liquid and Gaseous Oxygen"*
AV-10	*"Safe Handling and Use of Medical Equipment and Gases in a Homecare Environment"*
	'Handbook of Compressed Gases"

16. OTHER INFORMATION (Continued)

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302
Fax on Demand: 1-800/231-1366

AIR LIQUIDE

SAFETY DATA SHEET Copper Dichloride

Based on Directive 2001/58/EC of the Commission of the European Communities

IVOC-P1/IVOC-P1C/IVOC-P2/IVOC-P3

1. Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms: none
CAS No. : N.A.
EC index No. : N.A.
EINECS No. : N.A.
RTECS No. : N.A.
NFPA code : N.D.
Molecular weight : N.A.
Formula : N.A.

[redacted]

1.2 Use of the substance or the preparation:
Basic chemistry:catalyst

1.3 Company/undertaking identification:
Inovyl : A division of EVC Belgium SA/NV
Excelsiorlaan 3
1930 Zaventem
Tel. : +32 2 709 13 15
Fax : +32 2 709 13 24
Email: inovyl@inovyl.com

1.4 Telephone number for emergency:
+32 14 58 45 45
Brandweerinformatiecentrum voor gevaarlijke stoffen (B.I.G.)
Technische Schoolstraat 43A, B-2440 Geel

2. Composition/information on ingredients

Hazardous ingredients	CAS No. EINECS No.	Conc. in %	Hazard symbol	Risks (R-phrases)
copper dichloride	7447-39-4 231-210-2	9.5-17	T;N	25-36/38-50/53 (1)
aluminium oxide	1344-28-1 215-691-6		-	-

(1) For R-phrases in full: see heading 16

3. Hazards identification

- Harmful if swallowed
- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:
- Consult a doctor/medical service if irritation persists
- Rinse immediately with plenty of water
- Do not apply neutralizing agents

4.2 Skin contact:
- Consult a doctor/medical service if irritation persists
- Rinse with water
- Soap may be used

4.3 After inhalation:
- Remove the victim into fresh air
- Unconscious: maintain adequate airway and respiration
- Respiratory problems: consult a doctor/medical service

4.4 After ingestion:
- Consult a doctor/medical service if you feel unwell
- Immediately give lots of water to drink
- Never give water to an unconscious person

5. Fire-fighting measures

5.1 Suitable extinguishing media:
- Non combustible
- For surrounding fires:
  all extinguishing media allowed

5.2 Unsuitable extinguishing media:
- No data available

5.3 Special exposure hazards:
- On burning: release of (highly) toxic gases/vapours (chlorine)

5.4 Instructions:
- Dilute toxic gases with water spray
- Take account of toxic firefighting water
- Use firefighting water moderately and contain it

5.5 Special protective equipment for firefighters:
- Heat/fire exposure: compressed air/oxygen apparatus
- Heat/fire exposure: gas-tight suit

6. Accidental release measures

6.1 Personal protection/precautions: see heading 8.1/8.3/10.3

6.2 Environmental precautions:
- Prevent soil and water pollution
- Substance must not be discharged into the sewer
- Contain leaking substance, pump over in suitable containers
- Plug the leak, cut off the supply
- Dam up the solid spill
- Knock down/dilute dust cloud with water spray

6.3 Methods for cleaning up:
- Prevent dust cloud formation
- Scoop solid spill into closing containers
- Carefully collect the spill/leftovers
- Clean contaminated surfaces with an excess of water
- Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:
- Observe strict hygiene
- Avoid raising dust
- Do not discharge the waste into the drain
- Remove contaminated clothing immediately
- Clean contaminated clothing

7.2 Storage:
- Store in a well-ventilated area
- Meet the legal requirements
- Keep away from: heat sources

Storage temperature	: N.D.	°C
Quantity limits	: N.D.	kg
Storage life	: N.D.	days
Materials for packaging	:	
- suitable	: no data available	
- to avoid	: no data available	

7.3 Specific uses:
- See information supplied by the manufacturer

8. Exposure controls Personal protection

8.1 Exposure limit values:

copper dichloride

TLV-TWA	: 0.2 fu/ldu+ a(Cu)	mg/m³		ppm
TLV-STEL	: -(Cu)	mg/m³		ppm
OES-LTEL	:	mg/m³		ppm
OES-STEL	:	mg/m³		ppm
MAK	: 1 E	mg/m³		ppm
MAC-TGG 8 h	:	mg/m³		
MAC-TGG 15 min.	:	mg/m³		
VME-8 h	:	mg/m³		ppm
VLE-15 min.	:	mg/m³		ppm
GWBB-8 h	:	mg/m³		ppm
GWK-15 min.	:	mg/m³		ppm
EC	:	mg/m³		ppm
EC-STEL	:	mg/m³		ppm

aluminium oxide

TLV-TWA	: 10	mg/m³		ppm
TLV-STEL	: -	mg/m³		ppm
OES-LTEL	: 4 R/10 I	mg/m³	-	ppm
OES-STEL	: -	mg/m³	-	ppm
MAK	: 1.5 A	mg/m³		ppm
MAC-TGG 8 h	: 10	mg/m³		
MAC-TGG 15 min.	:	mg/m³		
VME-8 h	: 10	mg/m³	-	ppm
VLE-15 min.	: -	mg/m³	-	ppm
GWBB-8 h	: 10(Al)	mg/m³	-(Al)	ppm
GWK-15 min.	: -(Al)	mg/m³	-(Al)	ppm
EC	:	mg/m³		ppm
EC-STEL	:	mg/m³		ppm

Sampling methods:

- Copper, Dusts & Mists and fume	OSHA ID 121
- Copper, Dusts & Mists and fume	OSHA ID 125G
- Potassium and compounds	OSHA ID 121
- Aluminum & Compounds (as Al)	NIOSH 7013
- Copper Dust and fume	NIOSH 7029

8.2 Exposure controls:

8.2.1 Occupational exposure controls:
- Measure the concentration in the air regularly
- Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see heading 13

8.3 Personal protection:

8.3.1 respiratory protection:
- Dust production: dust mask with filter type P2

8.3.2 hand protection:
- Gloves
  Suitable materials: No data available
- Breakthrough time: N.D.

8.3.3 eye protection:
- Safety glasses
- In case of dust production: protective goggles

8.3.4 skin protection:
- Protective clothing
  Suitable materials: No data available

9. Physical and chemical properties

9.1 General information:

Appearance (at 20°C)	: Little spheres	
Odour	: Odourless	
Colour	: Green-brown	

9.2 Important health, safety and environmental information:

pH value	: N.D.	
Boiling point/boiling range	: N.D.	°C
Flashpoint	: N.A.	°C
Explosion limits	: N.D.	vol% (°C)
Vapour pressure (at 20°C)	: N.D.	hPa
Vapour pressure (at 50°C)	: N.D.	hPa
Relative density (at 20°C)	: N.D.	
Water solubility	: Poorly soluble	
Soluble in	: - No data available	
Relative vapour density	: N.D.	
Viscosity	: N.D.	Pa.s
Partition coefficient n-octanol/water	: N.D.	
Evaporation rate		
ratio to butyl acetate	: N.D.	
ratio to ether	: N.D.	

9.3 Other information:

Melting point/melting range	: N.D.	°C
Auto-ignition point	: N.D.	°C
Saturation concentration	: N.D.	g/m³

10. Stability and reactivity

10.1 Conditions to avoid/reactivity:
- Stable under normal conditions

10.2 Materials to avoid:
- Keep away from: heat sources

10.3 Hazardous decomposition products:
- On burning: release of (highly) toxic gases/vapours (chlorine) and formation of metallic fumes

11. Toxicological information

11.1 Acute toxicity:

copper dichloride

LD50 oral rat	:	N.D.	mg/kg
LD50 dermal rat	:	N.D.	mg/kg
LD50 dermal rabbit	:	N.D.	mg/kg
LC50 inhalation rat	:	N.D.	mg/l/4 h
LC50 inhalation rat	:	N.D.	ppm/4 h

11.2 Chronic toxicity:

aluminium oxide

EC carc. cat.	:	not listed
EC muta. cat.	:	not listed
EC repr. cat.	:	not listed
Carcinogenicity (TLV)	:	A4
Carcinogenicity (MAC)	:	not listed
Carcinogenicity (VME)	:	not listed
Carcinogenicity (GWBB)	:	not listed
Carcinogenicity (MAK)	:	not listed
Mutagenicity (MAK)	:	not listed
Teratogenicity (MAK)	:	not listed
IARC classification	:	not listed

11.3 Routes of exposure: ingestion, inhalation, eyes and skin

11.4 Acute effects/symptoms:

AFTER EYE CONTACT
- Slight irritation

11.5 Chronic effects:

- Not listed in carcinogenicity class (IARC,EC,TLV,MAK)
- Not listed in mutagenicity class (EC,MAK)
- Not classified as toxic to reproduction (EC)

12. Ecological information

12.1 Ecotoxicity:

copper dichloride:
- LC50 (96 h) : 0.08/0.5 mg/l (SALMO GAIRDNERI/ONCORHYNCHUS MYKISS)
- EC50 (48 h) : 0.026 mg/l (DAPHNIA MAGNA)
- EC50 (72 h) : 7 mg/l (CHLORELLA VULGARIS)

12.2 Mobility:

- **Volatile organic compounds (VOC): N.A.%**
- Poorly soluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- **biodegradation BOD_5** : N.A. **% ThOD**
- **water** : - No data available
- **soil** : **T ½:** N.D. **days**

12.4 Bioaccumulative potential:
- **log P_{ow}** : N.D.
- **BCF** : N.D.

12.5 Other adverse effects:

- **WGK** : 2 (Classification based on the components in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)
- **Effect on the ozone layer** : Not dangerous for the ozone layer (1999/45/EC)
- **Greenhouse effect** : no data available
- **Effect on waste water purification** : no data available

13. Disposal considerations

13.1 Provisions relating to waste:
- Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 16 08 02 (spent catalysts containing dangerous transition metals or dangerous transition metal compounds)
- Waste material code (Flanders): 455
- Hazardous waste (91/689/EEC)

13.2 Disposal methods:
- Recycle/reuse

13.3 Packaging/Container:
- Waste material code packaging (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

14. Transport information

14.1 Classification of the substance in compliance with UN Recommendations

UN number	: 3077
CLASS	: 9
SUB RISKS	: -
PACKING	: III
PROPER SHIPPING NAME	: UN 3077, Environmentally hazardous substance, solid, n.o.s. (copper dichloride) IVOC-P1/IVOC-P1C/IVOC-P2/IVOC-P3

14.2 ADR (transport by road)

CLASS	: 9
PACKING	: III
DANGER LABEL TANKS	: 9
DANGER LABEL PACKAGES	: 9

14.3 RID (transport by rail)

CLASS	: 9
PACKING	: III
DANGER LABEL TANKS	: 9
DANGER LABEL PACKAGES	: 9

14.4 ADNR (transport by inland waterways)

CLASS	: 9
PACKING	: III
DANGER LABEL TANKS	: 9
DANGER LABEL PACKAGES	: 9

14.5 IMDG (maritime transport)

CLASS	: 9
SUB RISKS	: -
PACKING	: III
MFAG	: -
EMS	: -
MARINE POLLUTANT	: P

14.6 ICAO (air transport)

CLASS	: 9
SUB RISKS	: -
PACKING	: III
PACKING INSTRUCTIONS PASSENGER AIRCRAFT	: 911/Y911
PACKING INSTRUCTIONS CARGO AIRCRAFT	: 911

14.7 Special precautions in connection with transport : none

14.8 Limited quantities (LQ) :

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:
each package shall display a diamond-shaped figure with the following inscription:
- 'UN 3077'
or, in the case of different goods with different identification numbers within a single package:
- the letters 'LQ'

15. Regulatory information

Classification according to directives 67/548/EEC and 1999/45/EC (**: see heading 16)

Harmful

Dangerous for the environment

Contains : copper dichloride

R22 : Harmful if swallowed
R51/53 : Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S(02) : (Keep out of reach of children)
S46 : If swallowed, seek medical advice immediately and show this container or label
S61 : Avoid release to the environment. Refer to special instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. - NOT APPLICABLE
N.D. - NOT DETERMINED
* - INTERNAL CLASSIFICATION

(**) Labelling:
The labelling of the substance described in this MSDS complies with the provisions of Directive 1999/45/EC of 31 May 2001, published in the Official Journal of the European Communities L 200 of 30/07/1999. This Directive replaces Directive 88/379/EEC of 7 June 1988, published in the Official Journal of the European Communities L 187 of 16/07/1988.
Member States shall apply the laws, regulations and administrative provisions referred to in article 22 of this Directive:
(a) to preparations not within the scope of Directive 91/414/EEC or Directive 98/8/EC as from 30 July 2002; and
(b) to preparations within the scope of Directive 91/414/EEC or Directive 98/8/EC as from 30 July 2004.

Full text of any R-phrases referred to under heading 2:
R25 : Toxic if swallowed
R36/38 : Irritating to eyes and skin
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Exposure limits:

TLV	:	Threshold Limit Value - ACGIH USA 2002
OES	:	Occupational Exposure Standards - United Kingdom 1999
MEL	:	Maximum Exposure Limits - United Kingdom 1999
MAK	:	Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK	:	Technische Richtkonzentrationen - Germany 2001
MAC	:	Maximale aanvaarde concentratie - The Netherlands 2002
VME	:	Valeurs limites de Moyenne d'Exposition - France 1999
VLE	:	Valeurs limites d'Exposition à court terme - France 1999
GWEB	:	Grenswaarde beroepsmatige blootstelling - Belgium 2002
GWK	:	Grenswaarde kortstondige blootstelling - Belgium 2002
EC	:	Indicative occupational exposure limit values - directive 2000/39/EC

I	:	Inhalable fraction - T: Total dust - E: Einatembarer Aerosolanteil
R	:	Respirable fraction - A: Alveolengängiger Aerosolanteil/Alveolar dust
C	:	Ceiling limit

a:	aerosol		r:	rook/Rauch	(fume)
d:	damp	(vapour)	st:	stof/Staub	(dust)
du:	dust		ve:	vezel	(fibre)
fa:	Faser	(fibre)	va:	vapour	
fi:	fibre		om:	oil mist	
fu:	fume		on:	olienevel/Ölnebel	(oil mist)
p:	poussière	(dust)	part:	particles	

Chronic toxicity:

K	:	List of the carcinogenic substances and processes - The Netherlands 2002

ETHYLENE

SECTION 1: IDENTIFICATION

Product Name: ETHYLENE

Product Number: 000000000000001068

Chemical Family: Alkene or Olefin Hydrocarbon.

CAS Number: 74-85-1

Chemical Name: Ethylene

Synonyms: Ethene, Bicarburetted hydrogen.

Manufacturer
Equistar Chemicals, LP
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston Texas 77252-2583

Business Contact
Customer Service
888 777-0232
Product Safety
800 700-0946

24 Hour Emergency Contact
CHEMTREC 800 424-9300
EQUISTAR 800-245-4532

SECTION 2 : COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS #	EU Inventory	Concentration Wt.%*	Risk	Symbol
Ethylene	74-85-1	200-815-3	<= 100.0	R12, R67	F+

* Concentration of gaseous products or materials is given in Mole %

Compositions given are typical values not specifications.

SECTION 3: HAZARD IDENTIFICATION

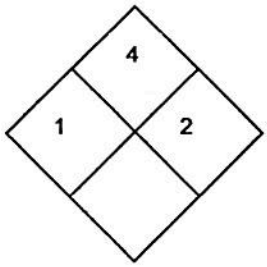
Emergency Overview

Signal Word
DANGER!

Hazards
EXTREMELY FLAMMABLE! Vapors can travel to a source of ignition and flash back. Containers may explode when heated. Vapors from liquefied gas are initially heavier than air and spread along the ground. Vapors may form explosive mixtures in the air.

ETHYLENE

NFPA®



HMIS®

Health	1
Flammability	4
Reactivity	2

Physical State
Gas.

Color
Colorless.

Odor
Slight sweet odor.

Odor Threshold
270 ppm

Potential Health Effects

Signs and Symptoms of Acute Exposure
See component summary.

- *Ethylene 74-85-1*

Simple asphyxiant, high concentrations can displace oxygen and cause drowsiness and dizziness. Contact with liquid may cause frostbite.

Skin
Although no appropriate human or animal health effects data are known to exist, this material is not expected to be a skin irritant. Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Inhalation
High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffication by asphyxiation.

Eye
Although no appropriate human or animal health effects data are known to exist, this material is not expected to cause eye irritation. Contact with liquid may cause frostbite.

Ingestion
Ethylene is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Chronic Health Effects
See component summary.

- *Ethylene 74-85-1*

No known chronic health effects.

Conditions Aggravated by Exposure

No additional information is available on whether overexposure to this material would aggravate other existing special medical conditions.

SECTION 4: FIRST AID MEASURES

General
Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 3 of this MSDS.

Skin
If frostbite has occurred, seek medical attention immediately; do not rub the affected area or flush with water. To prevent further damage, do not attempt to remove frozen clothing from affected area. If frostbite has not occurred, immediately and thoroughly wash contaminated skin with soap and water.

Inhalation
Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eye
If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persist seek medical attention.

Ingestion
Not applicable (gas).

SECTION 5: FIRE FIGHTING MEASURES

Flammable Properties

Classification
Flammable Gas

Flash Point:
-136 °C (-212.8 °F)

Auto-Ignition Temperature
490 °C (914 °F)

Lower Flammable Limit
2.7 vol%

Upper Flammable Limit
36 vol%

Protection of Firefighters

Protective Equipment/Clothing: Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Fire Fighting Guidance: Keep away from all ignition sources! This gas readily forms flammable mixtures with air at well below ambient temperatures. When exposed to an ignition source, it will burn in the open or explode in confined spaces. DO NOT extinguish a leaking gas fire unless leak can be stopped. Explosive atmosphere could form. Evacuate area and fight fire from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposure to heat; cool with flooding quantities of water until well after the fire is out. DO NOT direct water at source of leak or pressure relief devices, icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of "bullet" tanks.

Hazardous Combustion Products: Carbon oxides (CO, CO2)

SECTION 6: ACCIDENTAL RELEASE MEASURES

Release Response
Extremely flammable. Eliminate all sources of ignition. Let evaporate. If possible, turn leaking container so that gas escapes rather than liquid. Do not direct water at spill or source. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas.

SECTION 7: HANDLING AND STORAGE

Handling
Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded.

Storage
Compressed gases should be stored in a separate safety storage cabinet or room.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal Protection
Inhalation A respiratory protection program that meets OSHA's 29 CFR 1910.134 or ANSI Z88.2 requirements must be followed whenever workplace conditions warrant respirator use.

Skin Wear insulated gloves if contact with liquid is possible.

Eye Wear safety glasses. Where the opportunity for a splash or spray caused by high pressure or agitation of the material is possible, use a face shield and chemical goggles.

Occupational Exposure Limits

Component Name	Source / Date	Value	Type	Notation
Ethylene	US (ACGIH) / 2005	200 ppm		

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Gas. Colorless.

Odor: Slight sweet odor.

Odor Threshold: 270 ppm

pH: Not applicable.

Boiling Point/Boiling Range: -104 °C (-155.2 °F)

Freezing Point/Melting Point:

Flash Point: -136 °C (-212.8 °F)

Auto-ignition: 490 °C (914 °F)

Flammability: Flammable Gas

Lower Flammable Limit: 2.7 vol%

Upper Flammable Limit: 36 vol%

Explosive Properties: No Data Available.

Oxidizing Properties: No Data Available.

Vapor Pressure: 30400 mm Hg @ 0 °C (32 °F)

Evaporation Rate: Specific data not available.

Relative Density: Not applicable.

Relative Vapor Density: 0.98 (Air = 1.0)

Viscosity: Not applicable.

Solubility (Water): Easily soluble in cold water.

Partition Coefficient (Kow): Specific data not available.

Additional Physical and Chemical Properties: No additional information available.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability
The product is stable.

Conditions to Avoid
All sources of ignition.

Substances to Avoid
Does not react with water or common materials.

Decomposition Products
Carbon Monoxide and Carbon dioxide.

Hazardous Polymerization
Will polymerize only at elevated temperatures and pressure in the presence of a catalyst.

Reactions with Air and Water
Does not react with air, water or other common materials.

SECTION 11: TOXICOLOGICAL INFORMATION

PRODUCT INFORMATION

Product Summary

ETHYLENE

The acute toxicity of ethylene is low, but very high concentrations may cause anesthesia and asphyxia. There is no evidence to suggest that ethylene is a skin or eye irritant, but evaporating liquid may cause frost injuries. No adverse systemic effects have been reported in rodents following repeated exposure to high concentrations. There were no signs of reproductive or developmental toxicity observed in a screening inhalation test of rats exposed to high concentrations. Ethylene was negative for genotoxicity in vitro and in vivo and for carcinogenicity in a chronic study conducted in rats. Ethylene is metabolized in the body to ethylene oxide, a carcinogen and genotoxicant; however, this conversion is of doubtful toxicologic significance given ethylene's lack of demonstrated genotoxicity and carcinogenicity.

COMPONENT INFORMATION

- *Ethylene 74-85-1*

Acute Toxicity - Effects
Inhalation Simple asphyxiant.

Ingestion Ethylene is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin Contact Ethylene is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation
Skin None expected. Evaporating liquid may cause frost bite.

Eye None expected. Evaporating liquid may cause frost bite.

Sensitization
Not expected to be a sensitizer.

Target Organ Effects
Respiratory system. Skin. Eye.

Repeated Dose Toxicity
No adverse systemic effects to organs or organ systems were reported in rats following repeated high concentrations of 10,000 ppm ethylene.

Reproductive Effects
No signs of reproductive toxicity were observed in a screening inhalation test of rats exposed to up to 5,000 ppm ethylene.

Developmental Effects
No signs of developmental toxicity were observed in a screening inhalation test of rats exposed to up to 5,000 ppm ethylene.

Genetic Toxicity
Ethylene has been shown to be without genetic toxicity in tests conducted in vitro and in vivo. Ethylene is metabolized to the genotoxicant ethylene oxide; however, this conversion is of doubtful significance to ethylene genotoxicity as all of the tests of ethylene are negative.

Carcinogenicity
No increase in tumors was noted in rats that were exposed to up to 3000 ppm ethylene for 2 years. Ethylene is metabolized to the carcinogen ethylene oxide; however, this conversion is of doubtful significance to ethylene carcinogenicity given ethylene's negative results in genotoxicity studies and a rodent carcinogenicity bioassay. IARC has concluded that ethylene is not classifiable as to its carcinogenicity in humans (Group 3).

SECTION 12: ECOLOGICAL INFORMATION

PRODUCT INFORMATION

ETHYLENE

Ecotoxicity

See component summary.

Environmental Fate and Pathway

See component summary.

COMPONENT INFORMATION

- *Ethylene 74-85-1*

Ecotoxicity

When released to the environment, ethylene will volatilize rapidly.

Acute toxicity to fish
LC50 / 1 HOURS Lepomis humilis (orange-spotted sunfish) 22 - 25 mg/l
Summary: This material is classified as harmful to fish. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

LC50 / 96 HOURS fathead minnow 116 mg/l
Summary: (calculated)

LC50 / 96 HOURS bluegill. 85 mg/l
Summary: (calculated)

LC50 / 96 HOURS rainbow trout. 55 mg/l
Summary: (calculated)

Acute toxicity to aquatic invertebrates
LC50 / 48 HOURS waterflea (daphnia magna). 53 - 153 mg/l
Summary: (calculated) This material is classified as harmful to invertebrates. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Toxicity to aquatic plants
EC50 / 72 HOURS green algae (Selenastrum). 72 mg/l
Summary: This material is harmful to algae or higher aquatic plants. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

EC50 / 48 HOURS green algae (Selenastrum). 122.5 mg/l
Summary: (calculated)

Toxicity to microorganisms
/ 24 HOURS bacteria.
Summary: Survival Summary: Growth 79 - 84%

Chronic toxicity to fish
/ 32 d fathead minnow 15.3 mg/l
Summary: Calculated 30-day survival/growth

/ 28 d fathead minnow 13 mg/l
Summary: Calculated 30-day survival/growth

Chronic toxicity to aquatic invertebrates
NOEC / 16 d waterflea (daphnia magna). 37.4 mg/l
Summary: Calculated 16-day survival/reproduction

Environmental Fate and Pathway

When released into the environment, this material will volatilize rapidly.

Persistance and Degradability
Stability in Water: Rapid volatilization from water surfaces likely to occur. Not likely to adsorb to suspended solids and sediment in water. Gas may permeate through organic matter contained in sediments and suspended material. Measured water solubility of 131 mg/l at 25 degrees C.

Stability in Soil: Medium to high mobility in soil. Rapid volatilization from soil likely to occur. Not likely to adsorb to suspended solids and sediment in water. Gas may permeate through organic matter contained in sediments and suspended material.

Biodegradation: May be susceptible to microbial biodegradation. Oxidizes to ethylene oxide in soil and water. Hydrolysis not expected to be an important fate process. Estimated half-life in a model river is 1.6 hr. Undergoes photooxidation with OH in air with a half-life of 1.9 days. Degrades in atmosphere by reaction with ozone and nitrate radicals with respective half-lives of 6.5 and 190 days. Low potential for bioaccumulation.

Bioaccumulation: Low potential for bioaccumulation. Estimated BCF range of 4 to 40.

SECTION 13: DISPOSAL CONSIDERATIONS

Contaminated product/soil/water/empty containers may be U.S. Resource Conservation and Recovery Act (RCRA)/U.S. Occupational Safety and Health Administration (OSHA) hazardous waste due to possible presence of flammable gases. Comply with federal, state, or local regulations for disposal.

SECTION 14: TRANSPORT INFORMATION

Special Requirements
If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper Shipping Name Ethylene, refrigerated liquid

ID No. UN1038

Hazard Class 2.1

SECTION 15: REGULATORY INFORMATION

Regulatory Status

Country	Inventory	
Australia	AICS	X
Canada	DSL	X
Canada	NDSL	
China	IECS	X
European Union	EINECS	X
European Union	ELINCS	
European Union	NLP	
Japan	ENCS	X
Korea	ECL	X

X = All components are included or are otherwise exempt from inclusion on this inventory.

C = Contact Lyondell/Equistar by e-mail at product.safety@lyondell.com or product.safety@equistarchem.com for additional information.

Philippines	PICCS	X	
United States	TSCA	X	

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

No chemicals in this material with known CAS numbers are subject to the reporting requirements of CERCLA.

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
Fire Hazard.
Sudden Release of Pressure.

SARA 313

This material contains the following chemicals with known CAS numbers subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

Component	Reporting Threshold
Ethylene / CAS# 74-85-1	1.0%

State Reporting

This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins under California Proposition 65 at levels which would be subject to the proposition.

SECTION 16: OTHER INFORMATION

Latest Revision(s)
Conversion to SAP template. Revised Section(s): 11 12 April 20 2005 Revised Section(s): 11 Date of Revision: June 26 2006

DISCLAIMER OF RESPONSIBILITY

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Numerical Data Presentation
The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg

Language Translations

ETHYLENE

This document may be available in languages other than English.

< end of document >

OxyChem®

Responsible Care® Good Chemistry at Work

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Occidental Chemical Corporation
5005 LBJ Freeway
P.O. Box 809050
Dallas, Texas 75380-9050

24 HOUR EMERGENCY TELEPHONE: **1-800-733-3665 or 1-972-404-3228 (U.S.); 32.3.575.55.55 (Europe); 1800-033-111 (Australia)**

TO REQUEST AN MSDS: **MSDS@oxy.com or 1-972-404-3245**

CUSTOMER SERVICE: **1-800-752-5151 or 1-972-404-3700**

MSDS NUMBER: M34514

SUBSTANCE: HYDROCHLORIC ACID (HCl) (ALL GRADES)

TRADE NAMES:
Hydrochloric Acid (HCl) 10%, 14%, 20%, 28%, 20 Be, 22 Be, Technical

SYNONYMS:
Muriatic Acid; HCl solution; Aqueous hydrogen chloride

PRODUCT USE: process chemical, metal cleaning, water purification, petroleum industry

REVISION DATE: Jan 26 2006

2. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=1

HMIS RATINGS (SCALE 0-4): HEALTH=3 FLAMMABILITY=0 REACTIVITY=1

EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: liquid
ODOR: pungent odor
SIGNAL WORD: DANGER
MAJOR HEALTH HAZARDS: CAUSES BURNS TO THE RESPIRATORY TRACT, SKIN, EYES AND GASTROINTESTINAL TRACT. CAUSES PERMANENT EYE DAMAGE. MAY BE HARMFUL OR FATAL IF SWALLOWED.
PHYSICAL HAZARDS: May spatter or generate heat when mixed with water. Contact with metals may evolve flammable hydrogen gas.
PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: burns, cough, pulmonary edema
LONG TERM EXPOSURE: erosion of teeth
SKIN CONTACT:
SHORT TERM EXPOSURE: burns, ulceration
LONG TERM EXPOSURE: dermatitis
EYE CONTACT:
SHORT TERM EXPOSURE: burns, eye damage, blindness
LONG TERM EXPOSURE: to our knowledge, no effects are known
INGESTION:
SHORT TERM EXPOSURE: burns
LONG TERM EXPOSURE: ingestion of harmful amounts is unlikely

CARCINOGEN STATUS:
OSHA: No
NTP: No
IARC: No

3. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: WATER
CAS NUMBER: 7732-18-5
PERCENTAGE: 63-91

COMPONENT: HYDROGEN CHLORIDE
CAS NUMBER: 7647-01-0
PERCENTAGE: 9-36

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation/Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. Discard footwear which cannot be decontaminated. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Never give anything by mouth to an unconscious or convulsive person. If swallowed, do not induce vomiting. Give large amounts of water. If vomiting occurs spontaneously, keep airway clear. Give more water when vomiting stops. GET MEDICAL ATTENTION IMMEDIATELY.

NOTE TO PHYSICIAN: The absence of visible signs or symptoms of burns does NOT reliably exclude the presence of actual tissue damage. Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: May release toxic gases.

EXTINGUISHING MEDIA: Use extinguishing agents appropriate for surrounding fire.

FIRE FIGHTING: Keep unnecessary people away, isolate hazard area and deny entry. Wear NIOSH approved positive-pressure self-contained breathing apparatus. Move container from fire area if it can be done without risk. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Cool containers with water.

SENSITIVITY TO MECHANICAL IMPACT: Not sensitive

SENSITIVITY TO STATIC DISCHARGE: Not sensitive

FLASH POINT: not flammable

HAZARDOUS COMBUSTION PRODUCTS:
Thermal decomposition products or combustion: hydrogen chloride

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Evacuation of surrounding area may be necessary for large spills. Wear appropriate personal protective equipment recommended in Section 8 of the MSDS. Completely contain spilled material with dikes, sandbags, etc. Shut off ventilation system if needed. Reprocess or reuse if possible. Neutralize with soda ash or dilute caustic soda. Collect with appropriate absorbent and place into suitable container. Liquid material may be removed with a vacuum truck. Keep out of water supplies and sewers. This material is acidic and may lower the pH of the surface waters with low buffering capacity. Releases should be reported, if required, to appropriate agencies. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Store in rubber-lined steel, acid-resistant plastic or glass containers. Keep container tightly closed and properly labeled. Store in a cool, dry place. Store in a well-ventilated area. Do not store in aluminum container or use aluminum fittings or transfer lines. Dike and vent storage tanks. Keep separated from incompatible substances (see Section 10 of the MSDS).

HANDLING: Avoid breathing vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. When mixing, slowly add to water to minimize heat generation and spattering.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
HYDROGEN CHLORIDE, ANHYDROUS:
HYDROGEN CHLORIDE (HYDROCHLORIC ACID):
5 ppm (7 mg/m3) OSHA ceiling
2 ppm ACGIH ceiling

VENTILATION: Use closed systems when possible. Provide local exhaust ventilation where vapor or mist may be generated. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear safety glasses with side shields. Wear chemical safety goggles with a faceshield or chemical splash hood. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear chemical resistant clothing and rubber boots when potential for contact with the material exists. Always place pants legs over boots.

GLOVES: Wear appropriate chemical resistant gloves.

PROTECTIVE MATERIAL TYPES: neoprene, nitrile, polyvinyl chloride (PVC), rubber, Kappler(R) CPF3, Tychem(R)

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 50 ppm

RESPIRATOR: Where vapor concentration exceeds or is likely to exceed applicable exposure limits, a NIOSH approved respirator with acid gas canister is required. When an air-purifying respirator is not adequate or for spills and/or emergencies of unknown concentrations, a NIOSH approved self-contained breathing apparatus or airline respirator with full-face piece is required. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
APPEARANCE: clear
COLOR: colorless
ODOR: pungent odor

MOLECULAR WEIGHT: 36.46
MOLECULAR FORMULA: HCl
BOILING POINT: 140-221 F (60.0-105 C)
FREEZING POINT: -29 to 5 F (-34 to -15 C)
VAPOR PRESSURE: 14.6-80 mmHg @ 20 C
VAPOR DENSITY (air=1): 1.3 @ 20 C
SPECIFIC GRAVITY (water=1): 1.05-1.18
BULK DENSITY: 8.75-9.83 lbs/gal
WATER SOLUBILITY: 100%
PH: 2 (0.2% solution)
VOLATILITY: 9-36 % by volume
ODOR THRESHOLD: 0.3 ppm (causes olfactory fatigue)
EVAPORATION RATE: <1.00 (butyl acetate=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Contact with water may produce a strong exothermic reaction with spattering. Contact with metals may evolve flammable hydrogen gas. Hydrogen chloride may react with cyanide, forming lethal concentrations of hydrocyanic acid.

INCOMPATIBILITIES: metals, alkalis (such as sodium hydroxide), mercuric sulfate, perchloric acid, carbides of calcium, cesium, rubidium, acetylides of cesium and rubidium, phosphides of calcium and uranium, lithium silicide

HAZARDOUS DECOMPOSITION:
Thermal decomposition products or combustion: hydrogen chloride

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

HYDROCHLORIC ACID (HCl) (ALL GRADES):
TOXICITY DATA: Hydrochloric Acid: 900 mg/kg oral-rabbit LD50; 1108 ppm/1 hour(s) inhalation-rat; 3124 ppm/1hour(s) inhalation-rat LC50. Rinsed Draize Test: 5 mg/30 second(s) rabbit-eye mild. Standard Draize Test: 4% / 24 hour(s) skin-human mild. Inhalation will cause severe irritation and possible burns with coughing and choking. If inhaled deeply, edema and hemorrhage of the lungs may occur. Levels of 10-35 ppm may cause irritation of throat and 50-100 ppm is unbearable for 1 hour. Inflammation, destruction of nasal passages and breathing difficulties may occur with higher concentrations and may be delayed in onset. 1000-2000 ppm may be fatal. Prolonged exposure may cause discoloration and/or erosion of teeth. Contact with eyes causes immediate severe irritation with possible burns, permanent visual impairment, or total loss of sight. Contact with fumes or liquid may produce corrosive burns. Dermal exposure also results in irritation, pain, dermatitis, and ulceration. Ingestion may cause immediate burns of the mouth, esophagus, and stomach. Ingestion may cause intense pain, nausea, vomiting, bleeding, circulating collapse, shock and death.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory system (including asthma and other breathing disorders)

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: Hydrochloric Acid: 178 mg/L LC50 Goldfish (1 to 2 hour survival time); 100-330 mg/L LC50 Shrimp. 3.6 mg/L 48 hour(s) (static) LC50 Bluegill This material is believed to be toxic to aquatic life.

FATE AND TRANSPORT:
BIODEGRADATION: This material is inorganic and not subject to biodegradation.

PERSISTENCE: This material is believed not to persist in the environment. This material is believed to exist in the disassociated state in the environment. SOIL: Hydrogen chloride will sink into the soil. The acid will dissolve some soil material (in particular, anything with a carbonate base) and will be somewhat neutralized. The remaining portion is thought to transport downward to the water table. WATER: Dissociates almost completely and will be neutralized by natural alkalinity and carbon dioxide.

BIOCONCENTRATION: This material is believed not to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Reuse or reprocess if possible. Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D002.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Hydrochloric acid solution
ID NUMBER: UN1789
HAZARD CLASS OR DIVISION: 8
PACKING GROUP: II
LABELING REQUIREMENTS: 8
DOT HAZARDOUS SUBSTANCE(S):
Hydrochloric acid 5000 lb(s) (2270 kg(s))

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Hydrochloric acid solution
UN NUMBER: UN1789
CLASS: 8
PACKING GROUP/RISK GROUP: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
HYDROGEN CHLORIDE (HYDROCHLORIC ACID): 5000 LBS RQ (liquid)
CHLORINE: 10 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):

HYDROGEN CHLORIDE (HYDROCHLORIC ACID): 500 LBS TPQ (gas)

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: No
FIRE: No
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
HYDROGEN CHLORIDE (HYDROCHLORIC ACID): aerosol form only

This product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372. Refer to Section 3.

OSHA PROCESS SAFETY (29CFR1910.119):
HYDROGEN CHLORIDE (HYDROCHLORIC ACID): 5000 LBS TQ (gas)
CHLORINE: 1500 LBS TQ

FDA: This material has Generally Recognized as Safe (GRAS) status under specific FDA regulations. Additional information is available from the Code of Federal Register (CFR) which is accessible on the FDA's website.

STATE REGULATIONS:
California Proposition 65: This product may contain contaminants known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 State Drinking Water and Toxic Enforcement Act. For additional information, contact Customer Service.

NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW:
REPORTING REQUIREMENT:
WATER 7732-18-5 63-91%
HYDROGEN CHLORIDE 7647-01-0 9-36%

RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST:
HYDROGEN CHLORIDE 7647-01-0 9-36%
CHLORINE 7782-50-5 0-50 ppm

SPECIAL HEALTH HAZARD SUBSTANCE LIST:
HYDROGEN CHLORIDE 7647-01-0 9-36%

PENNSYLVANIA RIGHT TO KNOW:
REPORTING REQUIREMENT:
WATER 7732-18-5 63-91%
HYDROGEN CHLORIDE 7647-01-0 9-36%

HAZARDOUS SUBSTANCE LIST:
HYDROGEN CHLORIDE 7647-01-0 9-36%

ENVIRONMENTAL HAZARDOUS SUBSTANCE LIST:
HYDROGEN CHLORIDE 7647-01-0 9-36%

SPECIAL HAZARDOUS SUBSTANCE LIST:
Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: E.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): All the components of this substance are listed on or are exempt from the inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): All components of this product are listed on the DSL.

16. OTHER INFORMATION

MSDS SUMMARY OF CHANGES
1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
2. COMPOSITION, INFORMATION ON INGREDIENTS
11. TOXICOLOGICAL INFORMATION

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, SUITABILITY, STABILITY OR OTHERWISE. The information included herein is not intended to be all-inclusive as to the appropriate manner and/or conditions of use, handling and/or storage. Factors pertaining to certain conditions of storage, handling, or use of this product may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No suggestions for use are intended to, and nothing herein shall be construed as a recommendation to, infringe any existing patents or violate any laws, rules, regulations or ordinances of any governmental entity.

OxyChem®

Responsible Care® Good Chemistry at Work

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Occidental Chemical Corporation
5005 LBJ Freeway
P.O. Box 809050
Dallas, Texas 75380-9050

24 HOUR EMERGENCY TELEPHONE:	**1-800-733-3665 or 1-972-404-3228 (U.S.); 32.3.575.55.55 (Europe); 1800-033-111 (Australia)**
TO REQUEST AN MSDS:	**MSDS@oxy.com or 1-972-404-3245**
CUSTOMER SERVICE:	**1-800-752-5151 or 1-972-404-3700**

MSDS NUMBER: M35410

SUBSTANCE: CHLORINE, LIQUEFIED GAS

SYNONYMS:
Chlorine

PRODUCT USE: process chemical, water treatment chemicals, plastic manufacture

REVISION DATE: Jan 10 2006

2. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=4 FIRE=0 REACTIVITY=0

HMIS RATINGS (SCALE 0-4): HEALTH=3 FLAMMABILITY=0 REACTIVITY=0

EMERGENCY OVERVIEW:
COLOR: green to yellow gas, amber liquid
PHYSICAL FORM: liquefied gas
ODOR: irritating odor, pungent odor
SIGNAL WORD: DANGER
MAJOR HEALTH HAZARDS: HIGHLY TOXIC. MAY BE FATAL IF INHALED. CAUSES BURNS TO THE RESPIRATORY TRACT, SKIN AND EYES. MAY CAUSE CHEMICAL PNEUMONIA. MAY CAUSE PERMANENT EYE DAMAGE.

PHYSICAL HAZARDS: Oxidizer. Hazardous gas under pressure. May react explosively with organic materials. May ignite or explode on contact with combustible materials.
ECOLOGICAL HAZARDS: This material is highly toxic to aquatic organisms on an acute basis.
PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Store away from organic and combustible materials. Keep container tightly closed. Wash thoroughly after handling.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation (possibly severe), chemical burns, pulmonary edema
LONG TERM EXPOSURE: respiratory disorders
SKIN CONTACT:
SHORT TERM EXPOSURE: chemical burns, thermal burns
LONG TERM EXPOSURE: to our knowledge, no effects are known
EYE CONTACT:
SHORT TERM EXPOSURE: chemical burns, thermal burns
LONG TERM EXPOSURE: to our knowledge, no effects are known
INGESTION:
SHORT TERM EXPOSURE: ingestion of harmful amounts is unlikely
LONG TERM EXPOSURE: ingestion of harmful amounts is unlikely

CARCINOGEN STATUS:
OSHA: No
NTP: No
IARC: No

3. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: CHLORINE
CAS NUMBER: 7782-50-5
PERCENTAGE: 99.5-100

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation/Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: Immediately flush contaminated areas with water. Remove contaminated clothing, jewelry, and shoes immediately. Do not attempt to remove frozen clothing from frostbitten areas. Wash contaminated areas with soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure.

NOTE TO PHYSICIAN: Steroid therapy, if given early, has been reported effective in preventing pulmonary edema. Development of pulmonary edema may be delayed 48-72 hours.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials. May react explosively with organic materials. Most combustibles will burn in this material causing toxic gases.

EXTINGUISHING MEDIA: Use extinguishing agents appropriate for surrounding fire.

FIRE FIGHTING: Wear NIOSH approved positive-pressure self-contained breathing apparatus. Firefighters should wear a one piece, total-encapsulating suit of Butyl coated nylon or equivalent. Keep unnecessary people away, isolate hazard area and deny entry. Move container from fire area if it can be done without risk. Do not apply water directly to a leak. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Flame impingement on steel chlorine container will result in iron/chlorine fire causing rupture of the container.

SENSITIVITY TO MECHANICAL IMPACT: Not sensitive

SENSITIVITY TO STATIC DISCHARGE: Not sensitive

FLASH POINT: not flammable

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Evacuate unprotected personnel upwind or crosswind for at least 100 feet (800 feet for large spills) out of danger area. Wear appropriate personal protective equipment recommended in Section 8 of the MSDS. Remove sources of ignition. Stop leak if possible without personal risk. If a chlorine container is leaking, try to position it so that gas rather than liquid leaks. Apply emergency kit device if possible. For other than minor leaks, immediately implement predetermined emergency plan. Do not apply water directly to a leak. Reacts with water to form corrosive, acidic solution (hydrochloric acid). Keep out of water supplies and sewers. Call supplier, CHLOREP team, or CHEMTREC when help is needed. Releases should be reported, if required, to appropriate agencies. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Do not attempt to store, handle or use without complete review of The Chlorine Institute Chlorine Manual (Phone: (202) 775-2790). Store and handle in accordance with all current regulations and standards. Keep container tightly closed. Store in a well-ventilated area. Protect from sunlight. Do not apply heat. Keep away from heat, sparks and flame. Keep separated from incompatible substances (see Section 10 of the MSDS). Avoid contact with water. Reacts with water to form a corrosive, acidic solution. The vapor is heavier than air. Store away from basements, pits or other confined spaces. Make daily inspections for leaks. Protect from

physical damage.

HANDLING: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Liquified gas under pressure. Piping and equipment must be thoroughly cleaned of organics and moisture before use. Corrosive to most metals in the presence of moisture. Liquid lines must have suitable expansion chambers between block valves due to the high coefficient of expansion.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
CHLORINE:
1 ppm (3 mg/m3) OSHA ceiling
0.5 ppm (1.5 mg/m3) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)
1 ppm (3 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)
0.5 ppm ACGIH TWA
1 ppm ACGIH STEL

VENTILATION: Do not use in poorly ventilated or confined spaces. Use closed systems when possible. Provide local exhaust ventilation where vapor may be generated. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear safety glasses with side shields. Wear chemical safety goggles with a faceshield to protect against skin contact when appropriate. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing. When responding to accidental release of unknown concentrations, wear one-piece, total encapsulating suit of Butyl coated nylon or equivalent.

GLOVES: Wear chemical resistant, insulated gloves such as Perfect Fit NL-56(TM) or Best 6781R(TM).

PROTECTIVE MATERIAL TYPES: Perfect Fit NL-56(TM), Best 6781R(TM), Best Nitri Solve 727(TM), Tychem 10000 (TM)

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 10 ppm

RESPIRATOR: Where vapor concentration exceeds or is likely to exceed applicable exposure limits, a NIOSH approved respirator is required. When an air-purifying respirator is not adequate or for spills and/or emergencies of unknown concentrations, a NIOSH approved self-contained breathing apparatus or airline respirator with full-face piece is required. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
COLOR: green to yellow gas, amber liquid
PHYSICAL FORM: liquefied gas
ODOR: irritating odor, pungent odor
MOLECULAR WEIGHT: 70.91
MOLECULAR FORMULA: Cl2

BOILING POINT: -29.27 F (-34.04 C)
FREEZING POINT: -150 F (-101 C)
VAPOR PRESSURE: 5830 mmHg @ 25 C
VAPOR DENSITY (air=1): 2.4
SPECIFIC GRAVITY (water=1): 1.4 @ 15.6 C
DENSITY: 11.7 lbs/gal @ 15.6 C
WATER SOLUBILITY: 0.7% @ 20 C
PH: Not applicable
VOLATILITY: 100%
ODOR THRESHOLD: 0.31 ppm approximate
EVAPORATION RATE: Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Dry material is highly reactive with titanium and tin. Reacts with most metals at high temperatures or in the presence of moisture. Avoid contact with water. Reacts with water to form corrosive, acidic solution (hydrochloric acid). May react explosively with organic materials.

INCOMPATIBILITIES: ammonia, elemental metals, metal hydrides, carbides, nitrides, oxides, phosphides, sulfides, easily oxidized materials, organic materials, (e.g. petrochemicals, oils, greases), unstable and reactive compounds

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: None known.

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

CHLORINE, LIQUEFIED GAS:
TOXICITY DATA:
293 ppm/1 hour(s) inhalation-rat LC50; 137 ppm/1 hour(s) inhalation-mouse LC50
LOCAL EFFECTS:
Corrosive: inhalation, skin, eye
ACUTE TOXICITY LEVEL:
Toxic: inhalation
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: skin disorders, respiratory system (including asthma and other breathing disorders)
ADDITIONAL DATA: This material has tested positive in one or more in vitro mutagenicity assays.

HEALTH EFFECTS:
INHALATION:
ACUTE EXPOSURE:
Brief exposure may cause serious adverse effects, even death. Excessive exposure may produce severe irritation of the nose, throat and lungs. May cause pulmonary edema. The hazard at different concentration is reported to be as follows: 0.2 - 0.5 ppm (No immediate toxic effects); 1-3 ppm (Definite odor with irritation of eye and